MODEL AIRPLANE NEWS

JULY 1943 • 20 CENTS

LOCKHEED "LIGHTNING" P-38

(See page 2[illegible])

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FLASH NEWS

MOST horrifying news of this war has been the revelation of the capture of eight American fliers and murder of "some" of them by the Japanese Government in barbaric violation of Article 1 and Article 60 of the Geneva Prisoners of War Convention. This act, the most dastardly perpetrated against the peoples of the United States in this war, has emblazoned America and the world with a fury which will smolder until the last guilty Japanese has met his full and deserved punishment for the crime. Some of the prisoners have been identified as Lieuts. Hite, Hallmark, Meder, Nielson, Barr and Farrow and the remaining pair's identity has not, to date, been revealed. Nor have the names of the murdered officers, nor the punishment meted out to the remainder, been revealed by the Japanese Government. Certainly such atrocities, and others equally as revolting, deserve a measure-for-measure course of action for Americans and the sun will yet rise on the day of vindication of those who have died for freedom.

There is speculation that the famed Curtiss P-40 fighter, in all its various Tomahawk, Kittyhawk and Warhawk models, from the P-40A through the P-40F, has been discontinued as a combat airplane; the planes are being withdrawn for training purposes within the confines of the U. S. The P-40 filled a terrible gap in the ranks of America's fighters in the six-months period following Pearl Harbor at a time when the P-38 and P-47 Thunderbolts were as yet untried and therefore untested. With only 1,000 hp. available, the P-40 cannot stand the gaff of frontline fighting and it has now been replaced in the most important war zones with Lightning and Thunderbolt fighters both of 2,000 hp. or more.

Harry Woodhead, president of Consolidated-Vultee Aircraft Corp., has disclosed the firm is now at work on a helicopter design under the general engineering direction of famed William B. Stout, designer of Ford Trimotor and Stout series of "airmobiles." However, the Consolidated-Vultee design will be used as a post-war commercial model, unless the Army or Navy decides otherwise. A. N. Kemp, president of American Airlines, states the helicopter will prove the commuter's dream and visualizes inter-city air routes as well as intra-city travel for passengers from suburbs to shopping centers. The Sikorsky helicopter, world's first and only successful design, is now in Army and Navy experimental service and both services plan great things for its use on battlefields.

An American Consolidated B-24 Liberator four-motor bomber has crossed the Atlantic in just 6 hours, 20 minutes—a new record for the hop. Piloted by Capt. William S. May, the bomber ran into tailwinds with a velocity of greater than 100 mph on the 2,200 mile route.

The "New York Times" reports Vought-Sikorsky F4U-1 Corsair fighters have gone into action in the South Pacific and have crushed Japanese flights they have met. The speedy fighters, which can race through the sky at better than 400 mph, can fly higher than 35,000 ft. They are operating from Henderson Field on Guadalcanal and are used for ground strafing of enemy installations in addition to their sky-fighting tactics. In addition to production by Chance Vought Division of United Aircraft, they are also in production by Nash-Kelvinator and Goodyear Tire and Rubber firms.

According to "Seapower," official magazine of the Navy League, our new battleships can turn their 16-inch guns upward for air defense and special high explosive, short range, quick-firing ammunition has been developed solely for the purpose. Such tactics may have been used by Captain Thomas L. Gatch, whose new 35,000 ton battleship shot 32 known Japanese aircraft out of the sky in just 25 minutes in the South Pacific recently. It is believed many more were downed but the smoke of battle prevented confirming their destruction. Such a blast of 2500 pounds of T.N.T. by the big guns of the new, modern battleships might easily cover a spherical volume of sky several hundred yards across with high-explosive shrapnel. New evidence in the battle of battleship-vs-airplane can now be introduced into the controversy.

Air convoys over every single mile of the North Atlantic shipping lanes are now an actuality according to a report by Angus MacDonald, Canadian National Defense Minister for Naval Services and C. G. Powers, Minister for Air. Big Canadian and American bombers patrol the skies over the ships to a point in mid-Atlantic, where British bombers take over the task. The war against Hitler's submarines is beginning a new chapter of victory for the United Nations.

William L. Batt, vice-chairman of the War Production Board, states 100,000 airplanes will be built in the United States in 1943! Such a fleet of airplanes, larger than the Axis' combined fleets, is difficult to comprehend but breathtaking in its potency. Obviously there will not be this many airplanes in existence at one time, for losses will occur which will make us hard-put to keep the books in a favorable balance. But if in losing aircraft we succeed in destroying the enemy's airpower, which we have been doing successfully on every front, then the massed weight of American air production and fighting power will carry us through to the certain victory we cherish.

According to reports from 11th Naval District Headquarters, four-motor Con-

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15TH YEAR OF PUBLICATION

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Edited by
Charles Hampson Grant

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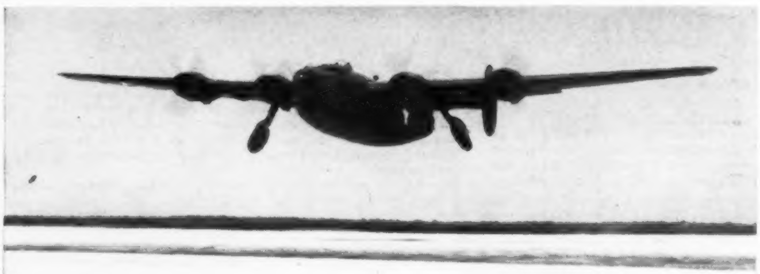
MacARTHUR CAN BEAT THE JAPS



Top The PBY patrolboats, hundreds of miles from their base, spy on Jap activities. *Above* Long range artillery B-24 bomber takes off to blast the Japs. *Below* The Navy's latest patrol bomber will play an important role in the Pacific conflict

MAKE no mistake about it: we are in for one helluva fight in the Pacific! The Japs will not be beaten this year, or next, or for several years to come, and not at all unless enormously increased flows of supplies, both men and machines, are established. Since December 7th, 1941, the Japanese has advanced, has pillaged, murdered, and destroyed his way throughout the South Pacific. He has taken every base he cherished, he has captured every important island and bastion listed in his master plan. And he is *still* winning his war. But he *must* be beaten and he *will* be beaten by: (1) Adequate manpower, airpower, and seapower and (2) Intelligent strategic and tactical use of this power by the military leaders of the United Nations in the South Pacific.

Two factors must be known concerning the enemy before military planning can be started: (1) What the enemy is after, and (2) How well is he prepared to get it.

Japan, unlike Germany, has no immediate plans for world conquest. She is now interested, only, in the consolidation of Eastern Asia and the Western Pacific into an united Japanese Empire. Her geopolotic plans call for the conquest of these lands and waters. And she is in no great hurry about it. These plans, in essence, were drawn up when the Empire began over two thousand years ago. Every move she has made in that lengthy period has been but a part of that plan. Germany's war against all mankind merely served as another opportunity to occupy the white man's strength and interest while she infiltrated in his backyard.

Should this war end, as it will, in a German and Italian defeat, Japan believes she will suffer no great loss; for if the war in the Pacific ends in a stalemate and consequent negotiated peace, Japan will have won, again! Politically she is the strongest nation on earth, for there are no political parties, no healthy opposition. The Japanese race, Japanese religion, and Japanese Government are all one and the same thing and Emperor Hirohito is at once the head of the Government and head of Japanese religion. That Japan is in no hurry to carry out her plans is borne out by the procedure she has established in the South Pacific. Those lands she held prior to Pearl Harbor she has established in an "inner zone" in which she has absorbed the peoples' lands, and financial enterprises as thoroughly as a boa constrictor digests a hog. She colonized islands that cartographers of England and the U.S. did not know existed. She invested capital, set up schools, and housed families in regions which were only pin points on maps. These lands Japan holds with a grip stronger than power, for they have become Japanese soils tilled by Japanese families, whose toils are processed in Japanese mills and refineries. In her outer zone (those lands conquered since Pearl Harbor) she has made no attempt to colonize or capitalize into Japanese lands; she has merely skimmed the cream from them, neatly scraped the top soil of natural resources, processing plants, and manufacturing facilities. Too, she has involved their capital enterprises in a seeming inextricable web. In the Philip-

What the Japs are doing to make their position impregnable and how MacArthur can destroy them

by **R. McLARREN**

pines she has transferred ownership of 51 percent of the stock of various firms to Japanese capitalists under various pseudonymes. Should we win back the Philippines and once again reinstate these firms, Japanese industrialists would profit because of the impossibility of completely disentangling these legal webs.

These, then, are the things the enemy wants. How well is he prepared to get them? To wage war a nation needs shipping, manpower, seapower, airpower, bases and raw materials and in no single one of these elements has Japan been defeated or even seriously impaired. According to Secy. of the Navy Frank Knox, the Japanese had a total of 6,369,000 tons of shipping at Pearl Harbor and of this total some 1,857,000 tons have been sunk or otherwise destroyed by the United Nations. Her present production is believed to be about 500,000 tons per year which she hopes eventually to increase to 750,000 tons per year. The War in the Pacific is primarily a fuel war and Japan has adequate tankers, enough, even, to use many of them for other supplies as well as troops.

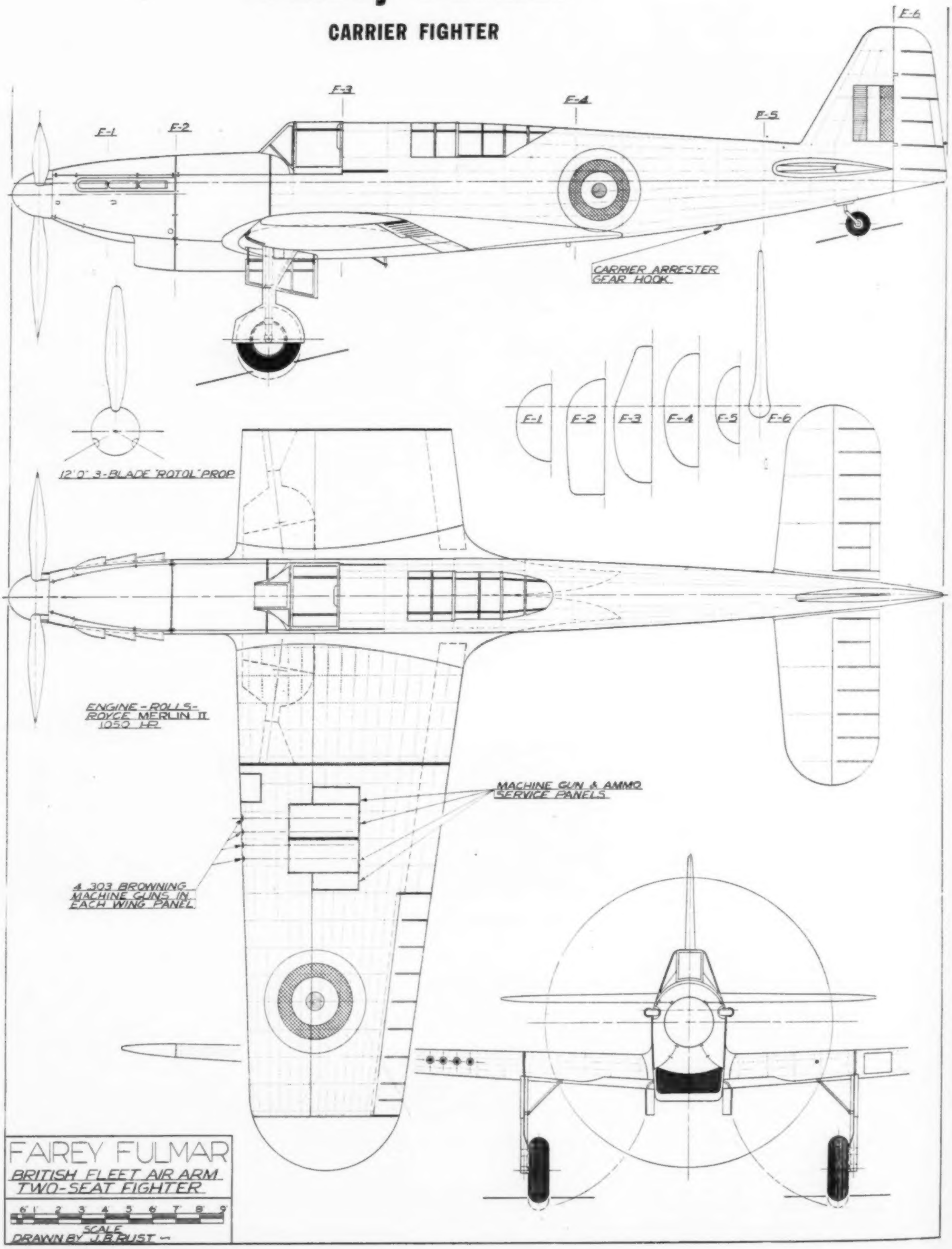
The Japanese Army has scarcely been touched. To capture and occupy the hundreds of practically undefended islands in the Southwest Pacific has required no huge armies and necessitates no powerful garrisons to hold the majority. No more than three or four Japanese divisions are now in contact with the United Nations and it is believed total Jap casualities to date do not exceed 40,000 killed, captured or wounded. Total strength of the Japa-

(Continued on page 41)

Top **The B-25 bomber has already damaged Japan and now makes ready for a second round.** *Above* **The Vultee Vanguard P-66 fighter attacks on the China front.** *Below* **A cargo plane tows a cargo glider into flight, bound for some remote base**

Fairey Fulmar

CARRIER FIGHTER



TRAIN WITH THIS NAVY TRAINER

How to build and fly a scale model of the Curtiss SNC-1

by **SYDNEY STRUHL**

IN Corpus Christi and other U. S. Naval training centers, Uncle Sam's Naval Cadets get the finest Naval Aviation training in the world. And the ship that they train in, the Curtiss SNC-1, is one of the finest training planes in the world. We present this ship as our flying scale feature of the month.

The Curtiss SNC-1 is the military version of the famed Curtiss Falcon Sportplane. This naval trainer is distinguished from its commercial counterpart by a long straight canopy. Top speed is 215 miles per hour; cruising speed, 195 mhp with a 420 horsepower Wright radial engine mounted in the nose. Service ceiling is estimated at 26,000 ft., highest of all trainers except the Republic AT-12. Military training complement probably includes fixed guns in each wing, flexible gun in the rear cockpit, two-way radio and practice bomb racks.

As a model the SNC-1 leaves little to be desired; it is graceful of line and sleek in appearance, making an attractive subject for any flying scale fan. Flight proportions and setup of the model are excellent and without exception is one of the best low-wing scale flying models of its size that the author has built.

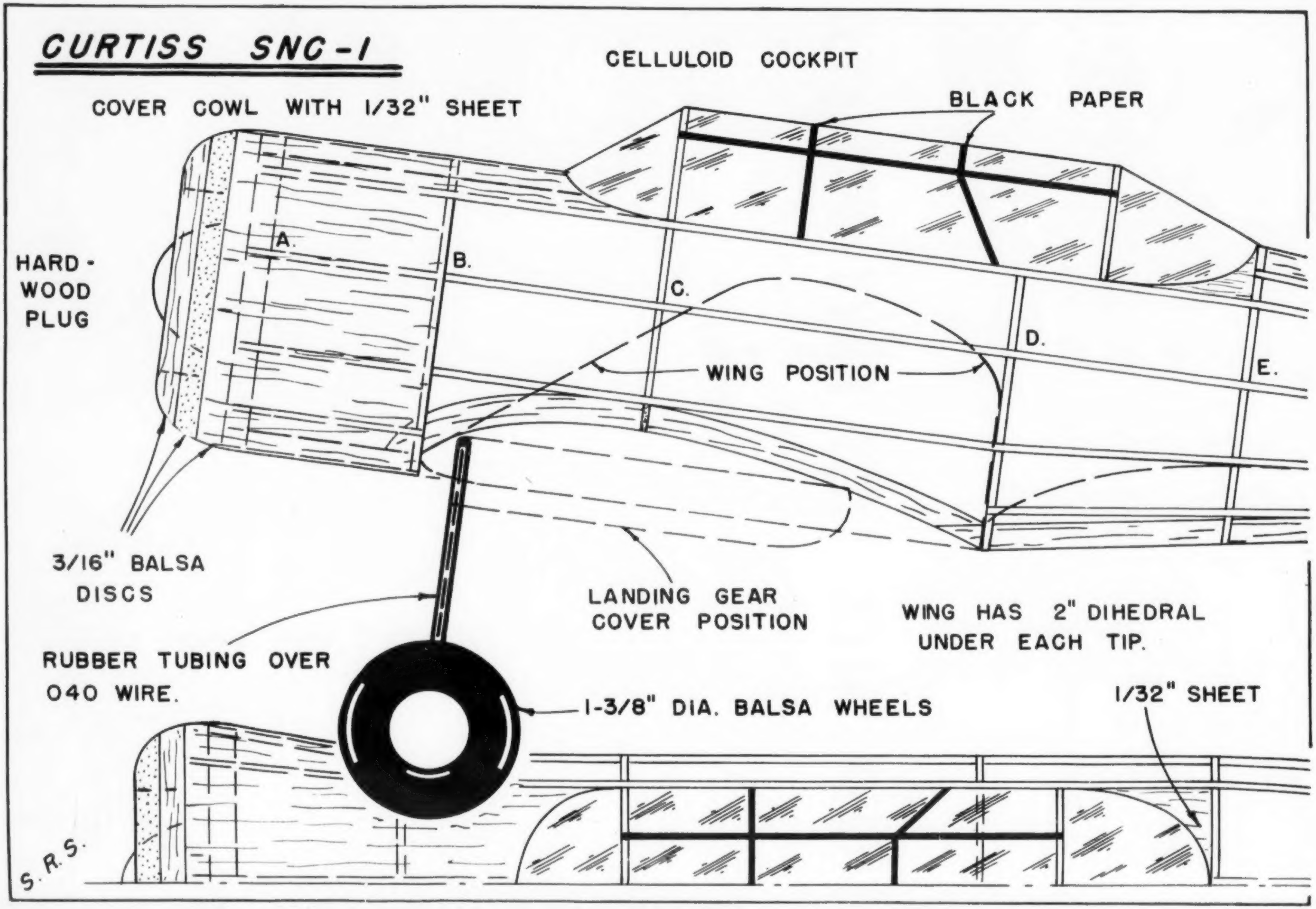
The model is simply constructed in the conventional manner. The author was lucky enough to obtain all the required balsa except the fuselage stringers, which were 1/16" square pine. Thus the plans were drawn to incorporate balsa wood, although the structure design is readily adaptable to construction using slightly heavier white pine or basswood now being sold at most model shops. All wood and sizes should be selected carefully to assure the lightest, strongest structure possible. In the process of assembly all frames should be made with accuracy and each joint cemented firmly.

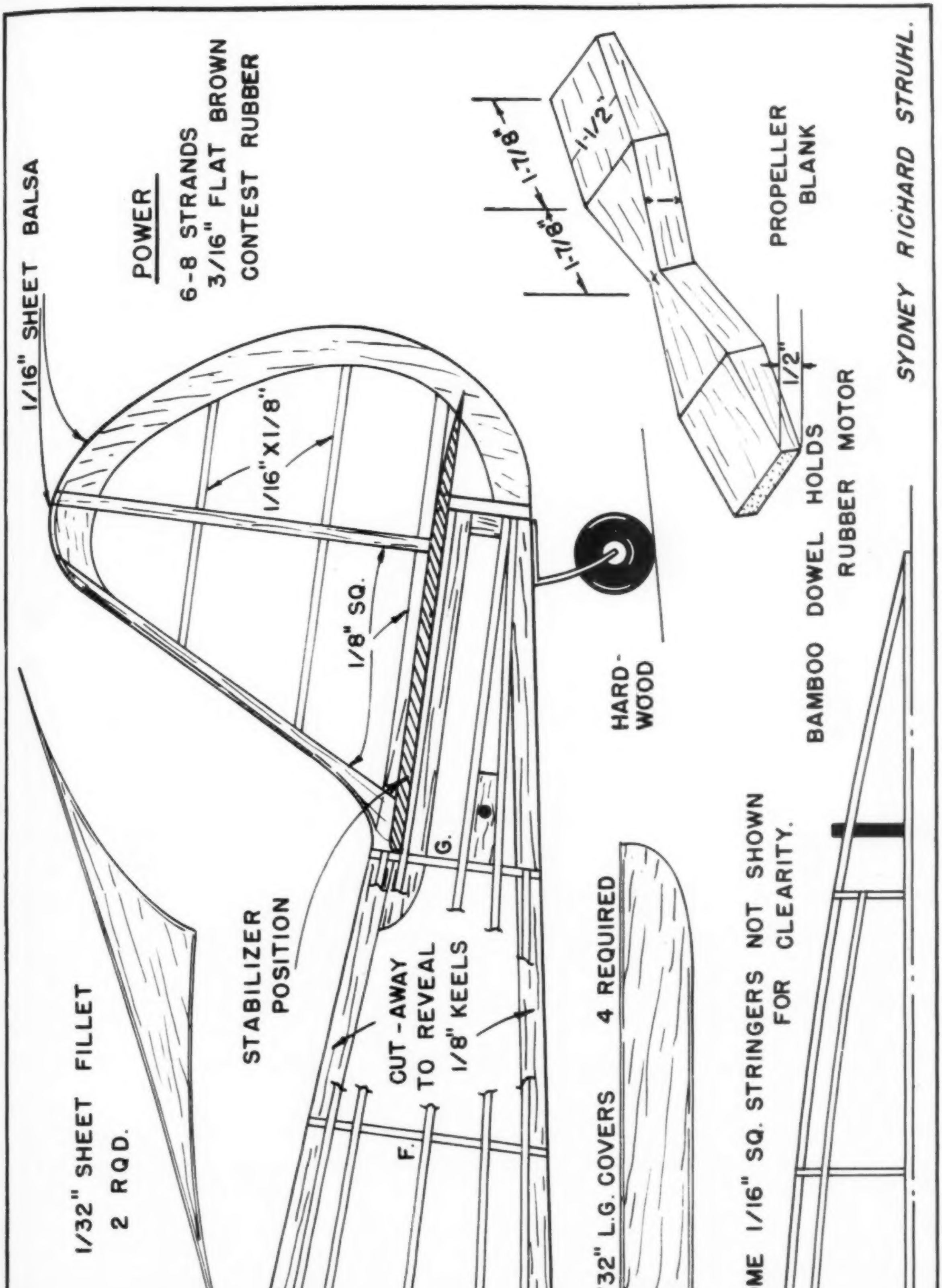
FUSELAGE: To keep the fuselage construction as simple as possible we employ the keel method. Begin by making the keel pieces. Trace top and bottom outlines of the fuselage side view to get the correct shape. Note that the bottom keel is a continuous piece extending from the nose to the tail, and the top keel is two separate pieces. Average depth of the keels is about 3/16"; they are cut from 1/8" sheet balsa. Fuselage bulkheads are shown full size on the plan; they are cut from medium grade 1/16" sheet balsa. Only half the bulkheads are shown, thus you will have to make two of each pattern shown. Cut the notches for the keels only; notches for the 1/16" sq. stringers are cut after the fuselage is assembled. Mark the stringer position, however, on the bulkheads during assembly on the plans.

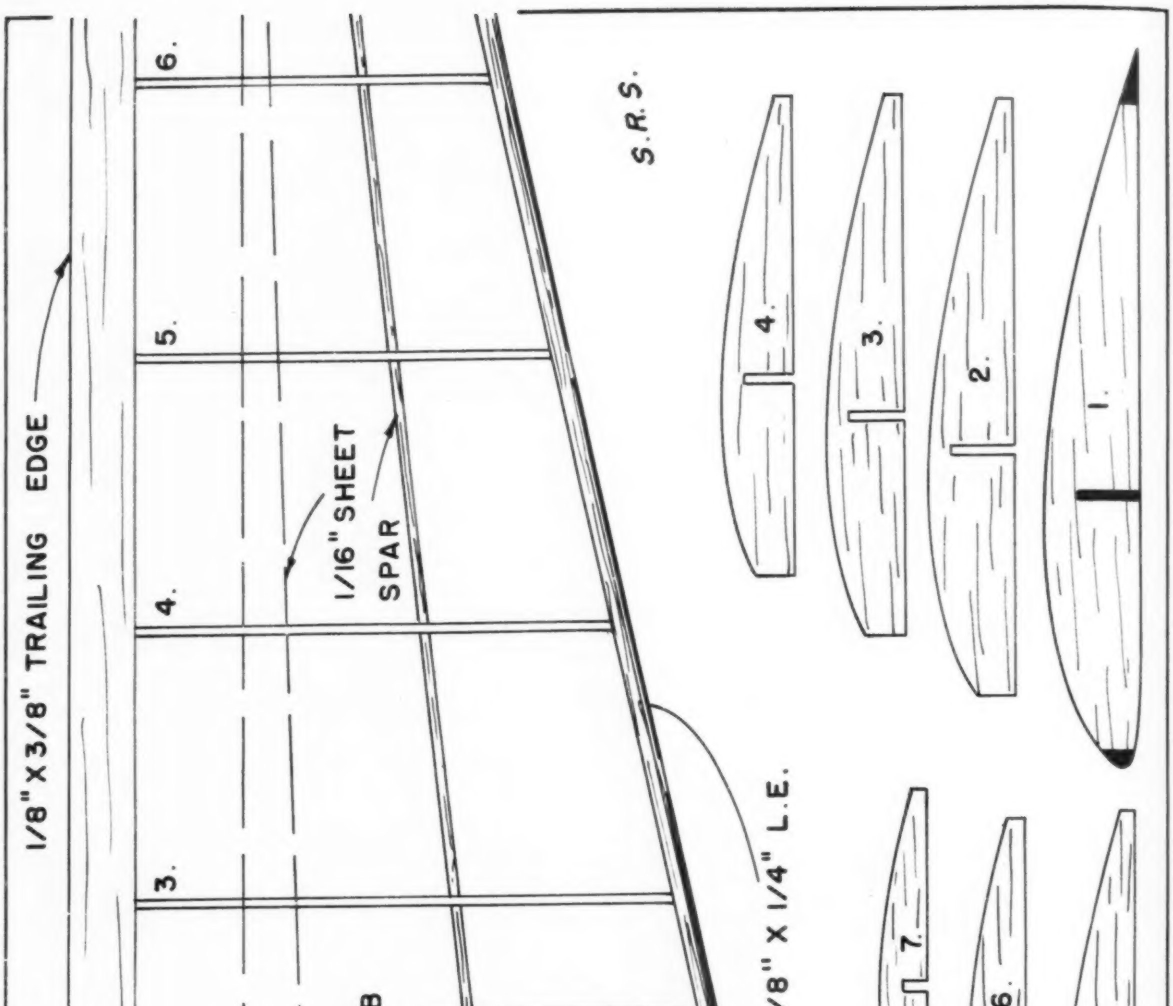
First pin the keel pieces into position over the plans and begin actual fuselage assembly. Temporarily cement a piece of 1/8" x 3/16" balsa between the top keels to join them at the opening created by the cockpit. Cement half the bulkheads to their respective positions and when dry remove from the plan and attach remaining bulkheads to the other side. Align the bulkheads accurately so they are exactly perpendicular to the keels. Cement the two 1/16" sq. stringers along the thrust line where a mark is provided on the bulkheads. Be careful not to pull the

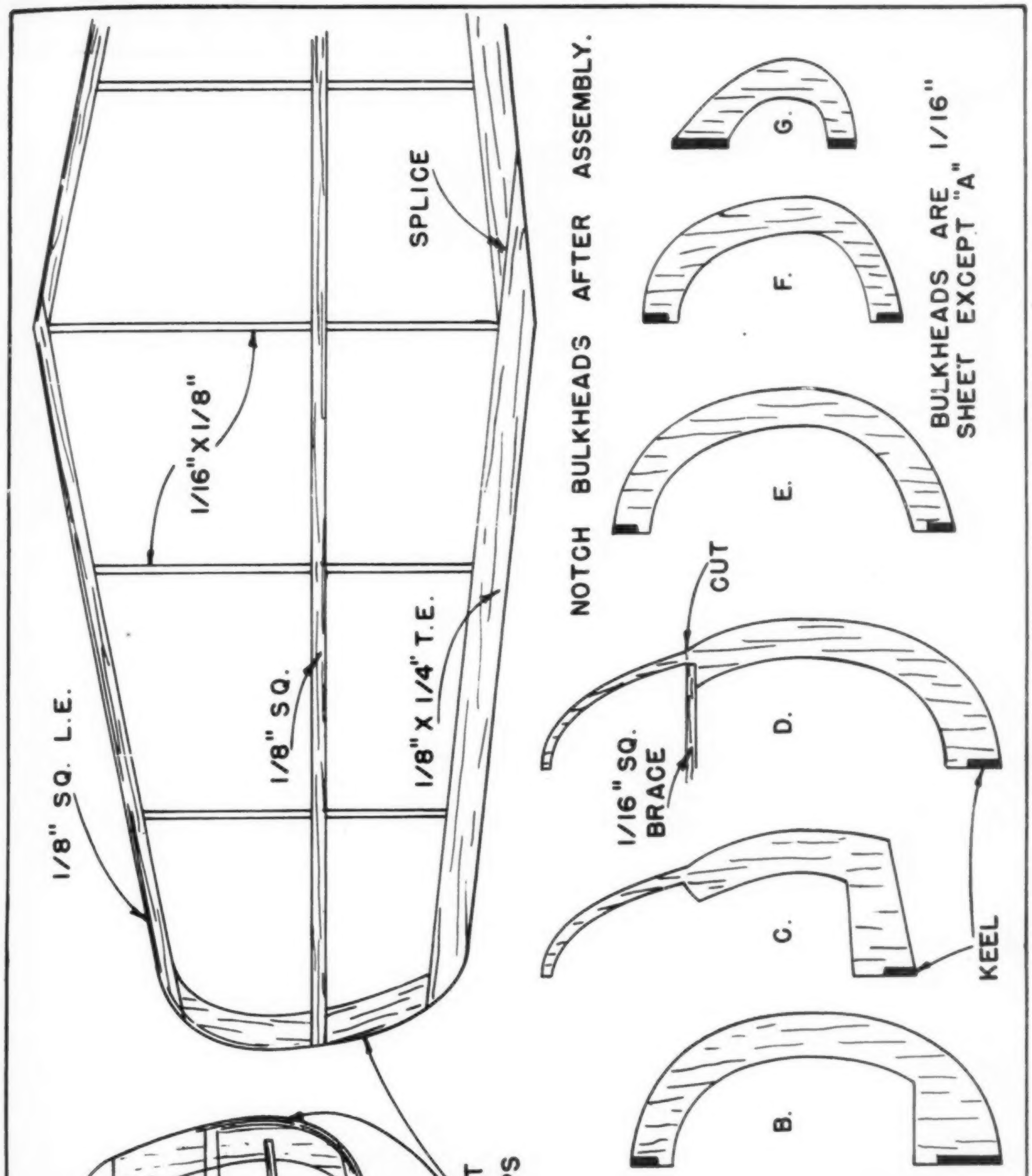
(Continued on page 36)

The finished model; a sturdy, realistic and consistent flier


CURTISS SNC-1
CELLULOID COCKPIT
COVER COWL WITH 1/32" SHEET
BLACK PAPER
HARD-WOOD PLUG
A.
B.
C.
D.
E.
WING POSITION
3/16" BALSA DISCS
LANDING GEAR COVER POSITION
WING HAS 2" DIHEDRAL UNDER EACH TIP.
RUBBER TUBING OVER 040 WIRE.
1-3/8" DIA. BALSA WHEELS
1/32" SHEET
S. R. S.


1/16" SHEET BALSA
POWER
6-8 STRANDS
3/16" FLAT BROWN
CONTEST RUBBER
1-7/8"
1-7/8"
1-1/2"
1"
PROPELLER
BLANK
1/2"
SYDNEY RICHARD STRUHL.
1/16"X1/8"
1/8" SQ.
HARD-
WOOD
BAMBOO DOWEL HOLDS
RUBBER MOTOR
1/32" SHEET FILLET
2 RQD.
STABILIZER
POSITION
G.
CUT-AWAY
TO REVEAL
1/8" KEELS
F.
1/32" L.G. COVERS
4 REQUIRED
SOME 1/16" SQ. STRINGERS NOT SHOWN
FOR CLEARITY.


1/8" X 3/8" TRAILING EDGE
1/16" SHEET SPAR
1/8" X 1/4" L.E.
FALSE RIB
LANDING GEAR POSITION
S.R.S.
ALL RIBS ARE 1/16" SHEET BALSA.
1.
2.
3.
4.
5.
6.
7.
FALSE RIB
℄


NOTCH BULKHEADS AFTER ASSEMBLY.
BULKHEADS ARE 1/16" SHEET EXCEPT "A"
SPLICE
1/16" X 1/8"
1/8" SQ. L.E.
1/8" SQ.
1/8" X 1/4" T.E.
CUT
1/16" SQ. BRACE
KEEL
1/8" SHEET BALSA TIPS
A. (3/16" SHEET)
B.
C.
D.
E.
F.
G.
7.

FRONTIERS

Latest and important developments in the science of air war

ONE of the least dramatic but most important types of planes is the observation ship. It is the "workhorse" of the services—Army and Navy. The crew of these ships observes and directs heavy gunfire, radioing corrections in firing necessary to hit targets at great distances. They take photographs of bombed areas and those to be bombed, supplying valuable information for destruction of vital war centers and military objectives. Without them gunfire would be far less accurate and the reduction of objectives would be haphazard, requiring a much greater amount of ammunition. By means of photographs taken from observation ships the destruction caused in any area by gunfire or bombs can be clearly seen and knowledge of the exact amount of damage estimated.

For instance, after a bombing raid a photographic observation plane flies over the area, taking a series of pictures that make possible a complete map of the bombed area. These are studied carefully by commanders who note the objectives destroyed and those that have escaped lethal fire. If the destruction has not been complete and certain vital enemy elements still function, another raid is organized and the particular targets are carefully noted and destroyed.

These ships, especially in the Navy, are also used for scouting. Here again their mission is often to take pictures of enemy strongholds or centers of activity. Information supplied by them is vital to accurate understanding and estimate of the enemy's movements and consequently to the success of any ensuing engagement.

Another vital function is the carrying of information or messages between the command points in the line, making it necessary for them to be able to take off and land in rough restricted areas.

Consequently the design of such a ship must be entirely different from fighter craft. Unlike the latter, high speed cannot be attained because low landing and take-off speeds are the first considerations. So, observation and liaison planes are designed primarily for slow landing. If, with any particular observation ship, high speed can also be obtained, it can be considered an outstanding craft. Designers have carried on intensive research to find means for slow landing; all sorts of experiments with high lift devices having been carried on in the wind tunnel and on test planes.

Obviously to attain a slow landing speed large wing area is required if normal wings are used. This makes the ship large and cumbersome, so the objective has been to attain high lift from small wing areas. This has led to the use of slots and flaps which make high lift coefficients possible.

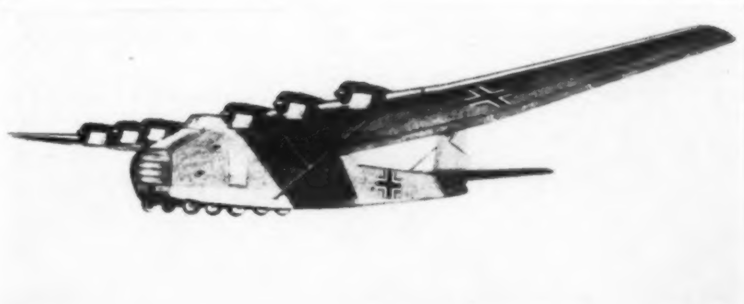
In the top picture of page 14 you see the Stinson L-1, new-type Army two place liaison plane. Here you notice that the

wings have been placed high to provide clear and unrestricted vision for the crew. Fairly large wings are used but they are equipped also with slots and flaps to obtain even greater lift.

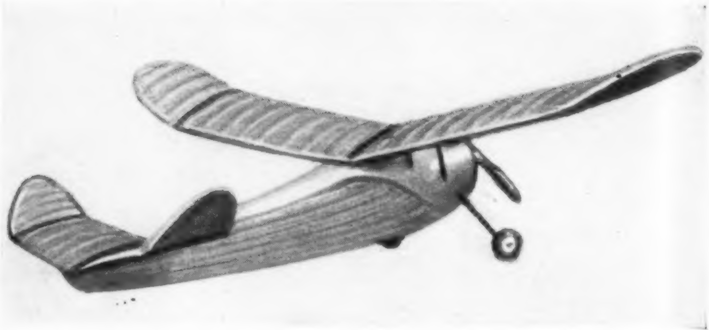
You will note the slots are on the leading edge; part of the leading edge has been pushed forward, providing a slot in the wing. In flight the air flows up through this slot and swiftly backward over the upper surface, providing a high speed layer of air close to the surface. At high angles of attack this reduces burbling, "kicking off" the turbulent and dead air from the top of the wing, thereby providing a smooth airflow and an unbroken "boundary layer." Because of this the wing will lift at an extremely high angle of attack before the airflow over it breaks and the stalling point is reached. With this increase in angle of attack comes greater lift.

In the picture flaps are hinged to the trailing edge of the wing. When these are deflected still greater lift results, due to greater deflection of the airstream leaving the wing. However when flaps are hinged to the wing without slots at their leading edge the airflow over them is disturbed and no extra lift is obtained. To make them effective it is necessary to provide a slot at the leading edge so the air beneath the

(Continued on page 57)



BIRD WING GAS MODEL



A stable consistent flier that soars like a bird

by GEO. EVALENKO

HERE we have an easily built, excellent performing contest model which has won or placed in every contest entered since the installation of a Super Cyclone. However, in powering this model, almost any Class C motor will do the trick.

Bystanders have been astounded by the amazing thermal tendencies the model exhibits; more often than not, a ground riser is all that is necessary to cause the owner quite a bit of consternation. The author attributes the extraordinary "floating qualities" to the Grant G-8 bird wing airfoil employed.

As one may note by glancing at the plans, an extremely stable aerodynamic force arrangement was used. The use of a lot of lateral area near the tail makes the "V" tail very efficient. This type of tail causes a properly designed model to whip into a corkscrew climb immediately, and utilizes more effectively the motor power.

In spite of the fact that the plane is a highly efficient contest model, it is not tricky under power, and has never spun in, looped, performed acrobatics, or shown any tendencies to do so. At the 1941 Nationals, because of maladjustments, the model circled in a 90 degree bank for ten seconds, neither gaining nor losing altitude. On the next flight, at half-throttle with a 15 sec. motor run and a Brown doing the work, it flew out of sight. The time was approximately one-half hour, and, of course, was unofficial. The last time the author flew the ship, it went out of sight in the only thermal of the day, and that in the evening.

In these trying days, rare enjoyment can be obtained from this consistent flying job. Time's awasting, so clear off the drawing board, and let's get started.

CONSTRUCTION: The plans must be enlarged six times to full size. A pair of dividers and a little patience (which every model builder is credited with having) are the two essentials needed. It is best to work from a centerline. Use the dividers to scale up all dimensions not given in the plans.

FUSELAGE: Put the top view of the fuselage in position on the workboard and place wax paper over it to protect your masterpiece. Select two pieces of 3/16" x 1" medium hard balsa of equal density; splice the hardwood motor bearers to them. After pinning the crutch pieces in place, add the cross pieces, and allow to dry thoroughly. Refer to perspective of assembled crutch if necessary. While waiting, cut out bulkheads, wing rest, tail former, etc. Now assemble bulkheads and firewall to crutch. Next add wing mount, top and bottom stringers, and cement cowl and nose blocks in place. Reglue all joints and check alignment of crutch. A glance at the assembled fuselage perspective might be helpful at this point.

Fasten coil securely to bulkhead No. 1, and, using standard wiring diagram, install ignition system. It must be realized that a good ignition system is essential for peak performance. Therefore, solder all connections well and check the entire unit. The timer and booster plug may be attached after fuselage is planked. Mount condenser on or near motor.

The battery box is mounted on a piece of 1/8" plywood, with a slot cut the length of it, by means of a bolt. Thus it is movable, and will aid greatly in balancing the model. Wires are connected to the box by clips so that the box is easily removable when it is necessary to change the medium size batteries. An unexpected advantage of this method is its shock-proof nature. In the event of a one-point landing (Heaven forbid!) the battery box will slide almost the length of the plywood and thus absorb the shock. The author has seen many crash landings in which flying batteries caused the sole damage.

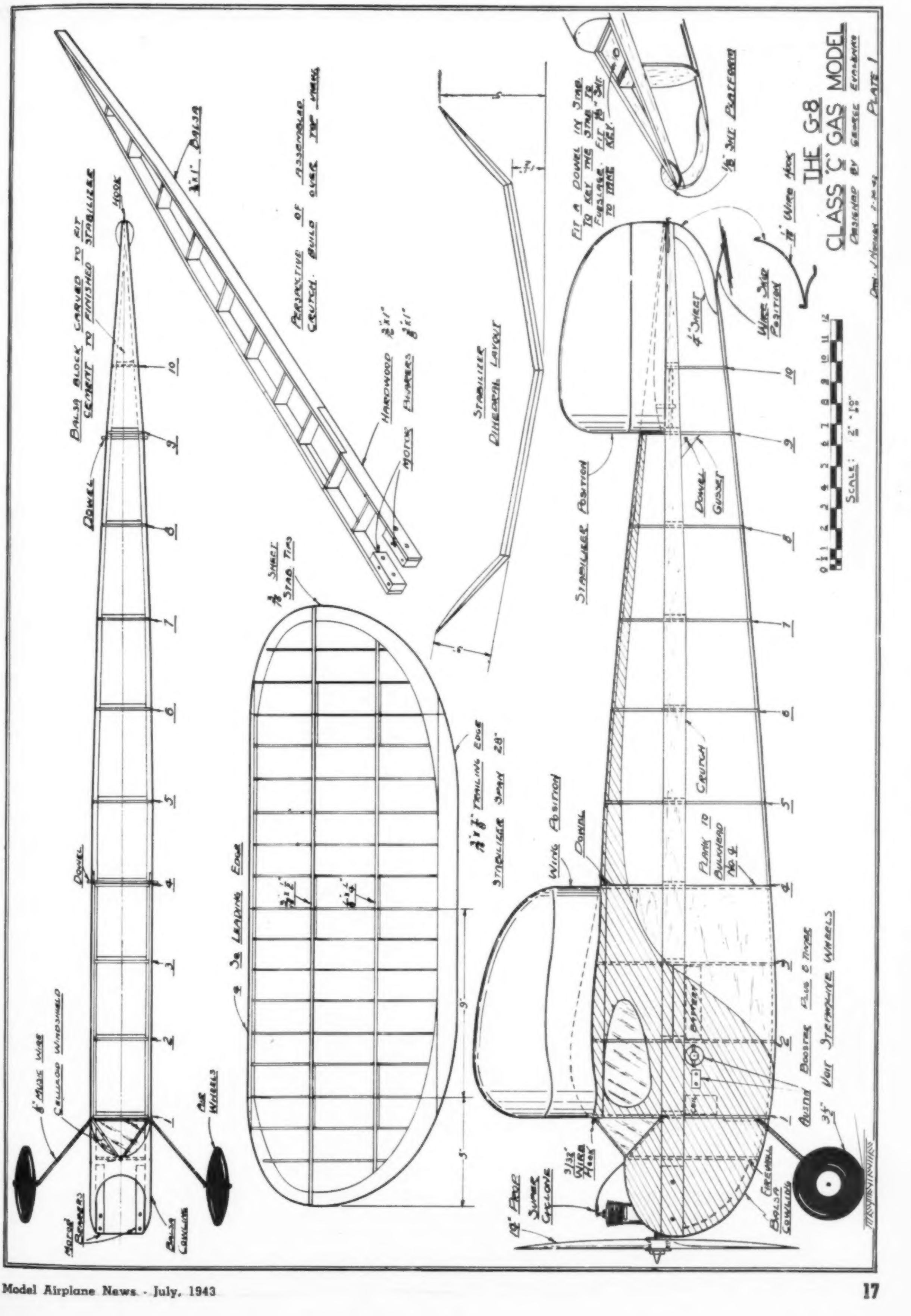
Drill holes in plywood bulkhead No. 1, to attach landing gear. Form landing gear as per plate 2 from 1/8" music wire, and bind firmly with wire. A drop of solder will anchor wire to landing gear solidly. Now cover cabin sides with soft 1/8" sheet. Plank the portion of the fuselage below the crutch with soft 1/8" x 1/4" from the firewall to bulkhead No. 4. Work from each side equally until the bottom stringer is reached.

Now add stringers spaced as your judgment dictates. Shape the cowl and nose blocks roughly. Reglue the entire fuselage; when dry, sand thoroughly first with fairly rough sandpaper, and then with a finer variety. Attach windshield braces and cut out windows from medium thick celluloid. Make a template of front windshield, from stiff writing paper, and, using it as a pattern, cut out celluloid windshield. Glue booster plug and timer securely in place after soldering connections. Be sure to mount plug and timer on the right-hand side of the model in order to clear exhaust fumes. The two, being close together make for easy changing from boosters to inside batteries. Cement in place dowels for wing and tail. Bind and glue front wing hooks to cabin. Install keel and adjustment blocks for tail (see plate 1).

Fuselage is now ready for covering. Use any good covering material made in U.S.A. Cover over planking for additional strength. Dope covering about eight

(Continued on page 36)

Above **This unique model with its bird wing section soars on the slightest up-current of air. Note the combination fin-stabilizer tail plane.** *Left* **The author with his G-8 bird wing plane before the flight on which it disappeared**



THE G-8
CLASS "C" GAS MODEL
PLATE 1
BALSA BLOCK CARVED TO FIT CEMENT TO FINISHED STABILIZER
HOOK
DOWEL
1/8" MUSIC WIRE
CELLULOID WINDSHIELD
AIR WHEELS
MOTOR BEARERS
BALSA COWLING
PERSPECTIVE OF ASSEMBLED CRUTCH. BUILD OVER TOP VIEW
HARDWOOD
MOTOR BEARERS
3/4" SHEET STAB. TIPS
SQ. LEADING EDGE
TRAILING EDGE
STABILIZER SPAN 28"
9"
5"
STABILIZER DIHEDRAL LAYOUT
FIT A DOWEL IN STAB. TO KEY THE STAB. TO FUSELAGE. FIT TO MAKE KEY.
1/8" SHT. PLATFORM
WIRE HOOK
WIRE SKID POSITION
SCALE: 2" = 10"
1/4" SHEET
STABILIZER POSITION
DOWEL GUSSET
CRUTCH
PLANK TO BULKHEAD NO. 4
WING POSITION
DOWEL
BATTERY
AUSTIN BOOSTER PLUG & TIMER
3 1/2" VEIT STREAMLINE WHEELS
3/32" WIRE HOOK
14" PROP
SUPER CYCLONE
FIREWALL
BALSA COWLING
1 2 3 4 5 6 7 8 9 10

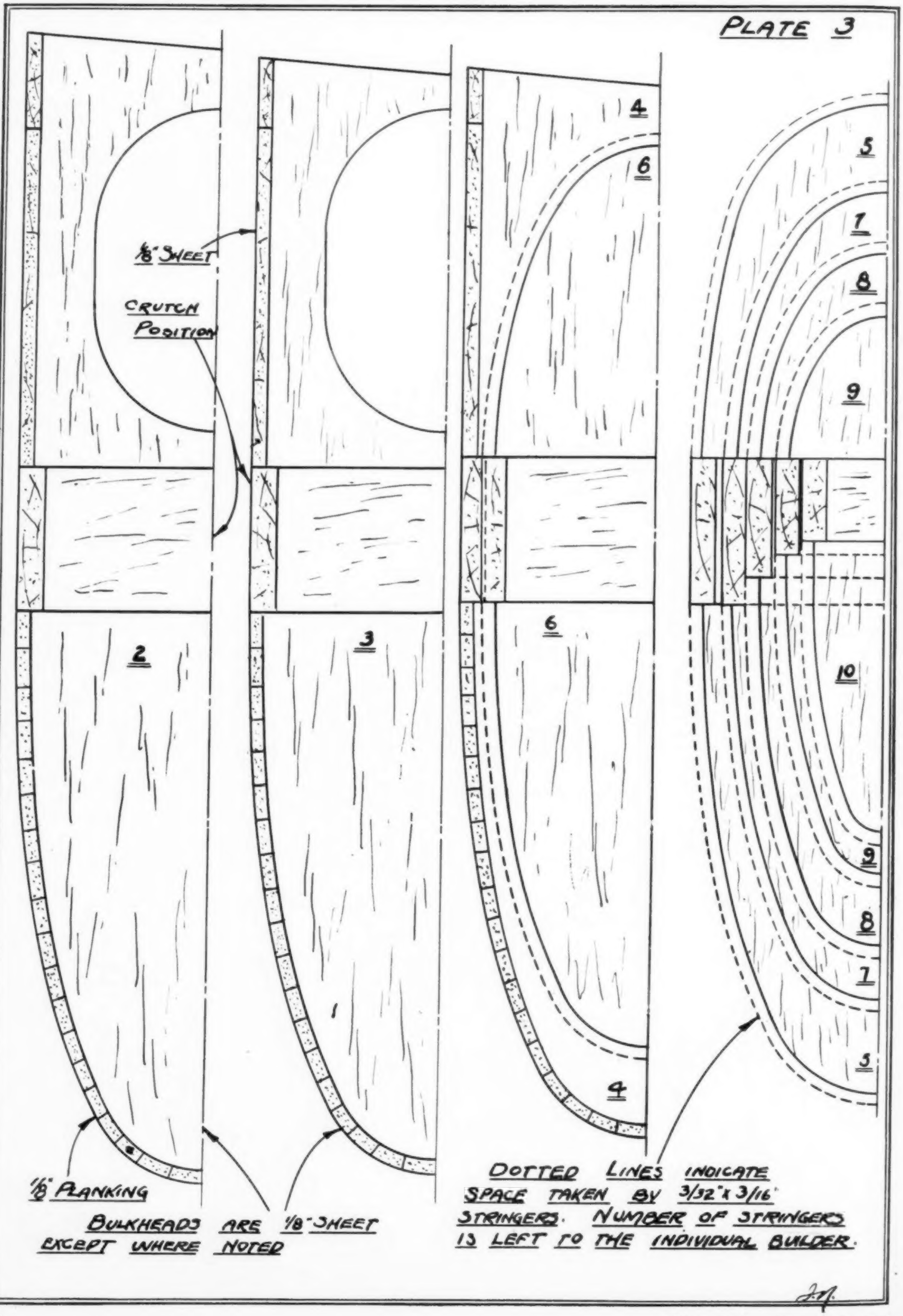
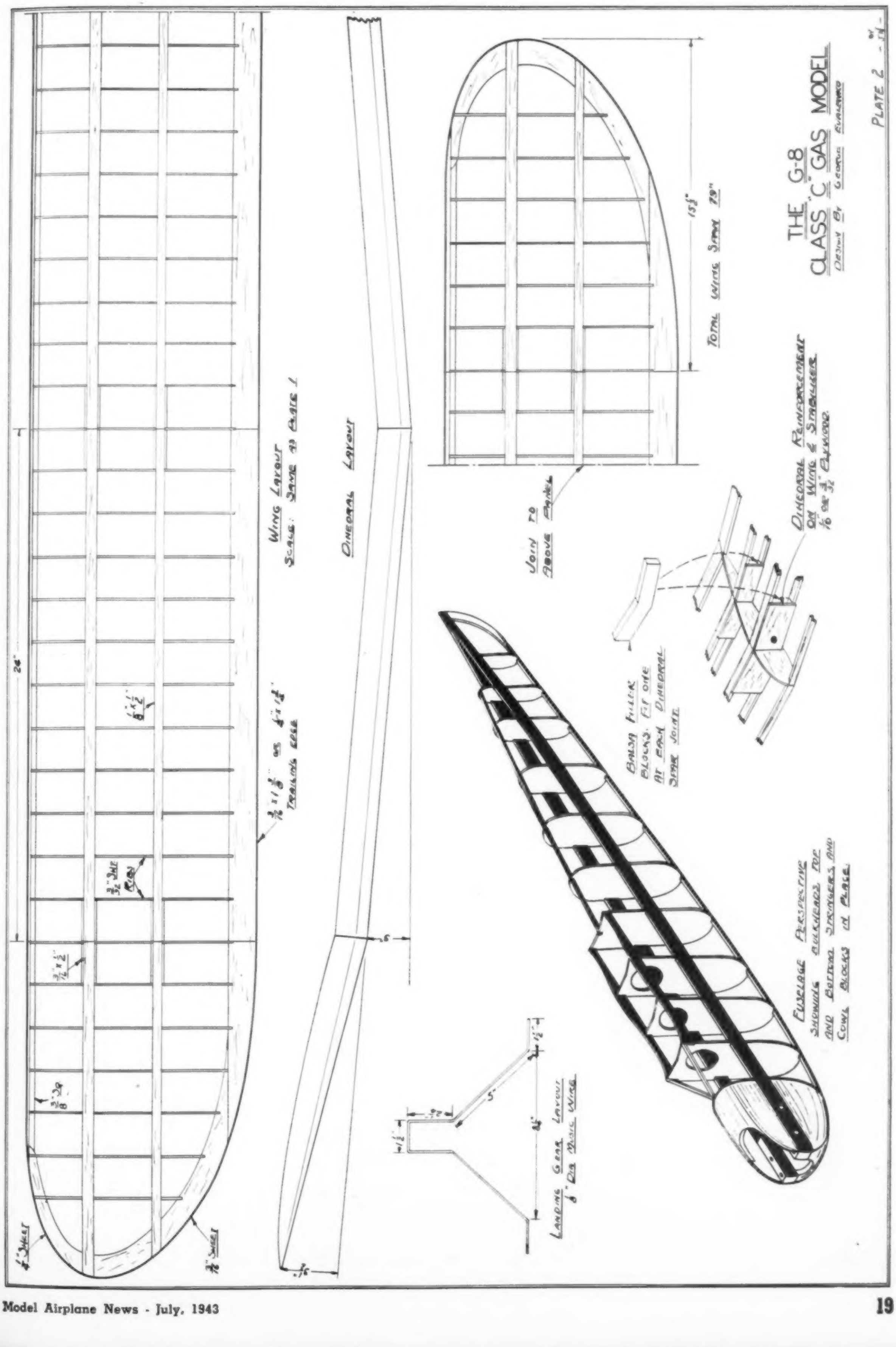
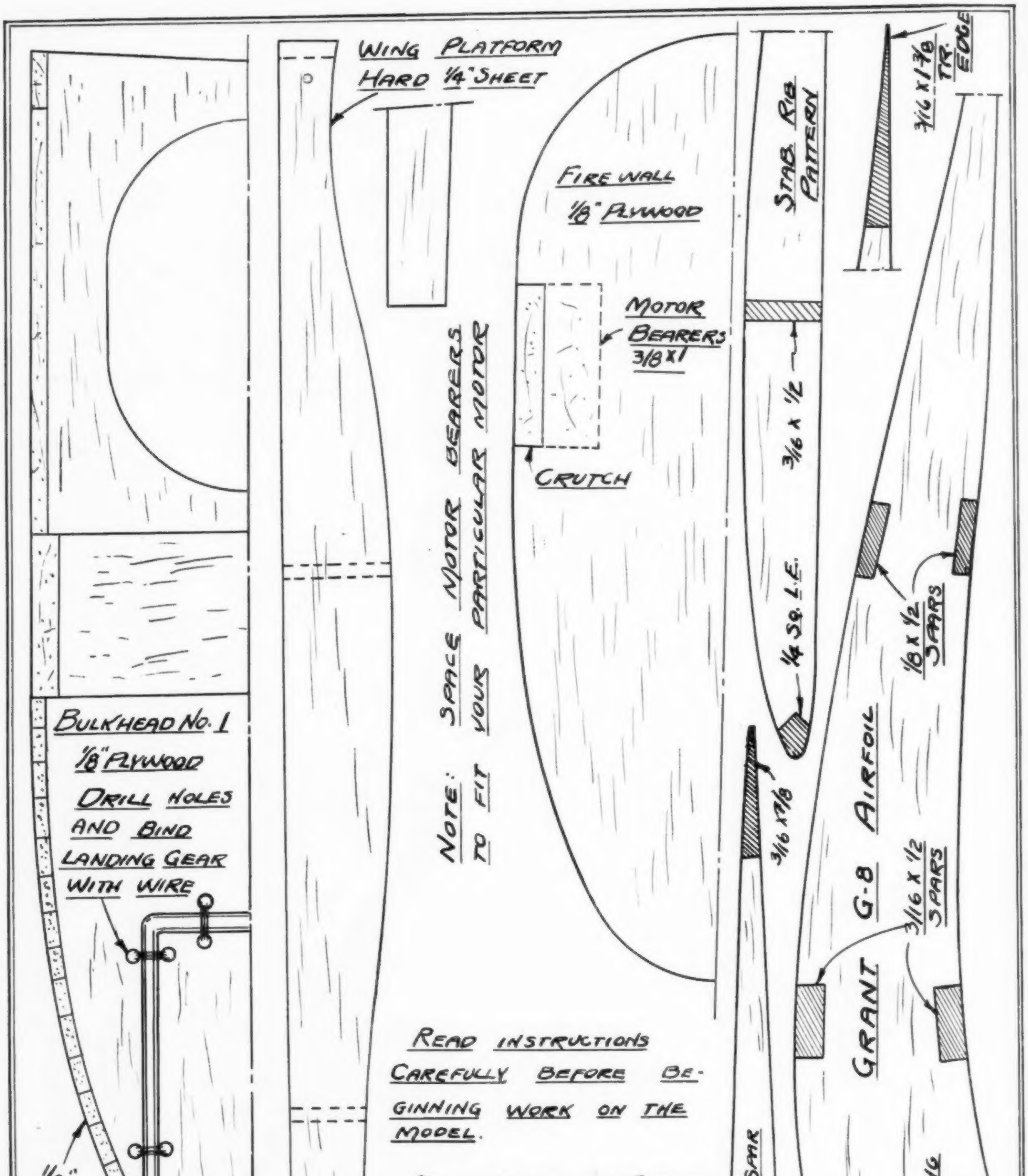


PLATE 3
1/8" SHEET
CRUTCH POSITION
2
3
4
6
6
4
5
7
8
9
10
9
8
7
5
1/8" PLANKING
BULKHEADS ARE 1/8" SHEET EXCEPT WHERE NOTED
DOTTED LINES INDICATE SPACE TAKEN BY 3/32" x 3/16" STRINGERS. NUMBER OF STRINGERS IS LEFT TO THE INDIVIDUAL BUILDER.

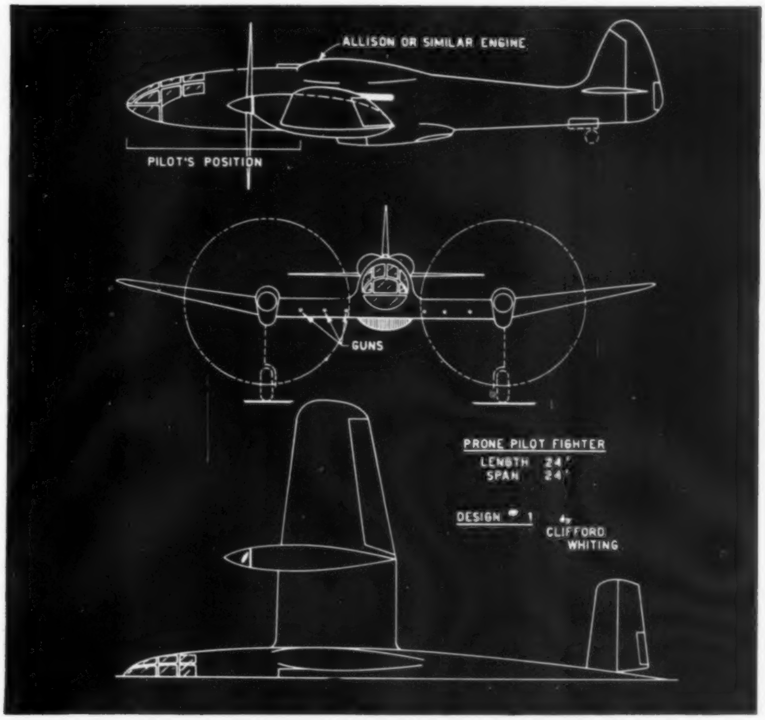

THE G-8
CLASS "C" GAS MODEL
PLATE 2
WING LAYOUT
SCALE: SAME AS PLATE 1
DIHEDRAL LAYOUT
TRAILING EDGE
JOIN TO ABOVE PANEL
TOTAL WING SPAN 79"
DIHEDRAL REINFORCEMENT ON WING & STABILIZER
BALSA FILLER BLOCKS: FIT ONE AT EACH DIHEDRAL SPAR JOINT
FUSELAGE PERSPECTIVE SHOWING BULKHEADS TOP AND BOTTOM STRINGERS AND COWL BLOCKS IN PLACE.
LANDING GEAR LAYOUT
MUSIC WIRE



WING PLATFORM
HARD 1/4" SHEET
FIRE WALL
1/8" PLYWOOD
MOTOR BEARERS 3/8 x 1
CRUTCH
NOTE: SPACE MOTOR BEARERS TO FIT YOUR PARTICULAR MOTOR
STAB. RIB PATTERN
3/16 x 1/2
1/4 Sq. L.E.
3/16 x 7/8
3/16 x 1 7/8 TR. EDGE
1/8 x 1/2 SPARS
GRANT G-8 AIRFOIL
3/16 x 1/2 SPARS
LEADING EDGE
3/8" Sq
1/8 x 1/4 SPAR
BULKHEAD NO. 1
1/8" PLYWOOD
DRILL HOLES AND BIND LANDING GEAR WITH WIRE
1/8" PLANK-ING
1/8" MUSIC WIRE
READ INSTRUCTIONS CAREFULLY BEFORE BE-GINNING WORK ON THE MODEL.
ALL PARTS ON PLATES 3 AND 4 ARE FULL SIZE.
A FULL SIZE METAL TEMPLATE OF THE RIBS WILL MAKE THE JOB EASIER.
PLATE 4

AIRPLANE DESIGN FORUM

Analysis and discussion of ideas and answers to perplexing problems submitted by readers



IN THOUSANDS of schools throughout the country young Americans are learning many important facts about aviation, especially about aerodynamics and construction of airplanes. In most cases, however, training is not given in putting these facts together in constructive form. It is very much like a man who knows how to make bricks or understands how to cut up his lumber but has never designed a house in which these should be used.

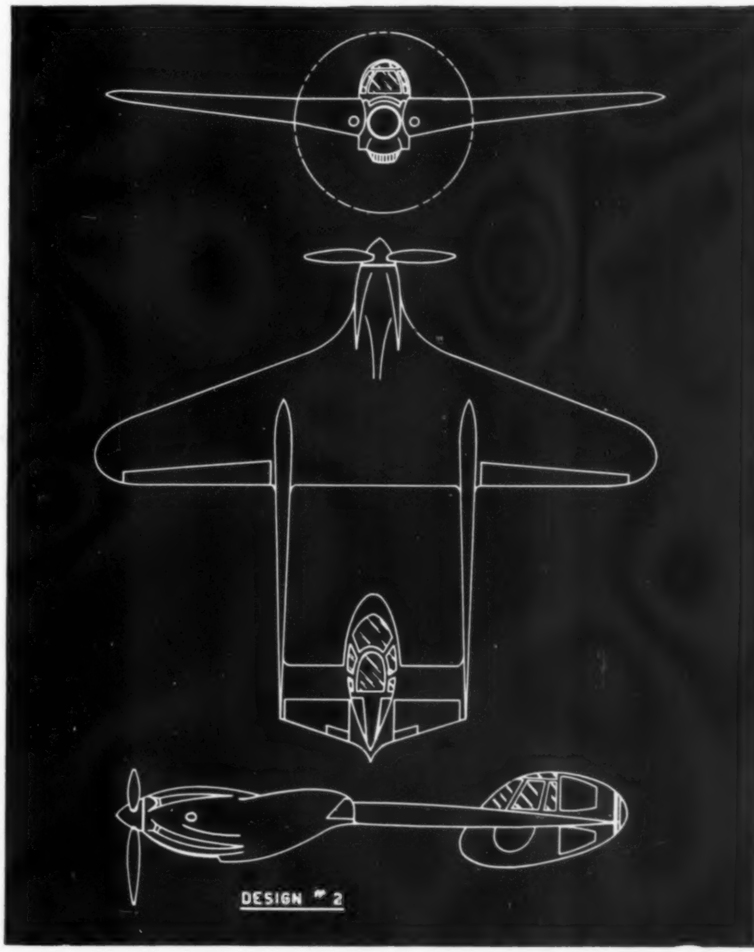
The Airplane Design Forum has been created to fill this need—to show our readers how individual aerodynamic facts should be correlated and put together in the form of an efficient airplane for any particular purpose. Performance requirements and the flying conditions met by any aircraft determine its design, that is, the proportions of one part relative to another.

The Airplane Design Forum appeared first in the May issue. In response to our request for mail we have been flooded with answers from hundreds of our aviation enthusiasts, and the file of ideas submitted rivals the secret files of the United States. Certainly there is no dearth of imagination and clear thinking on the part of young America; they need only the opportunity and place to express these ideas.

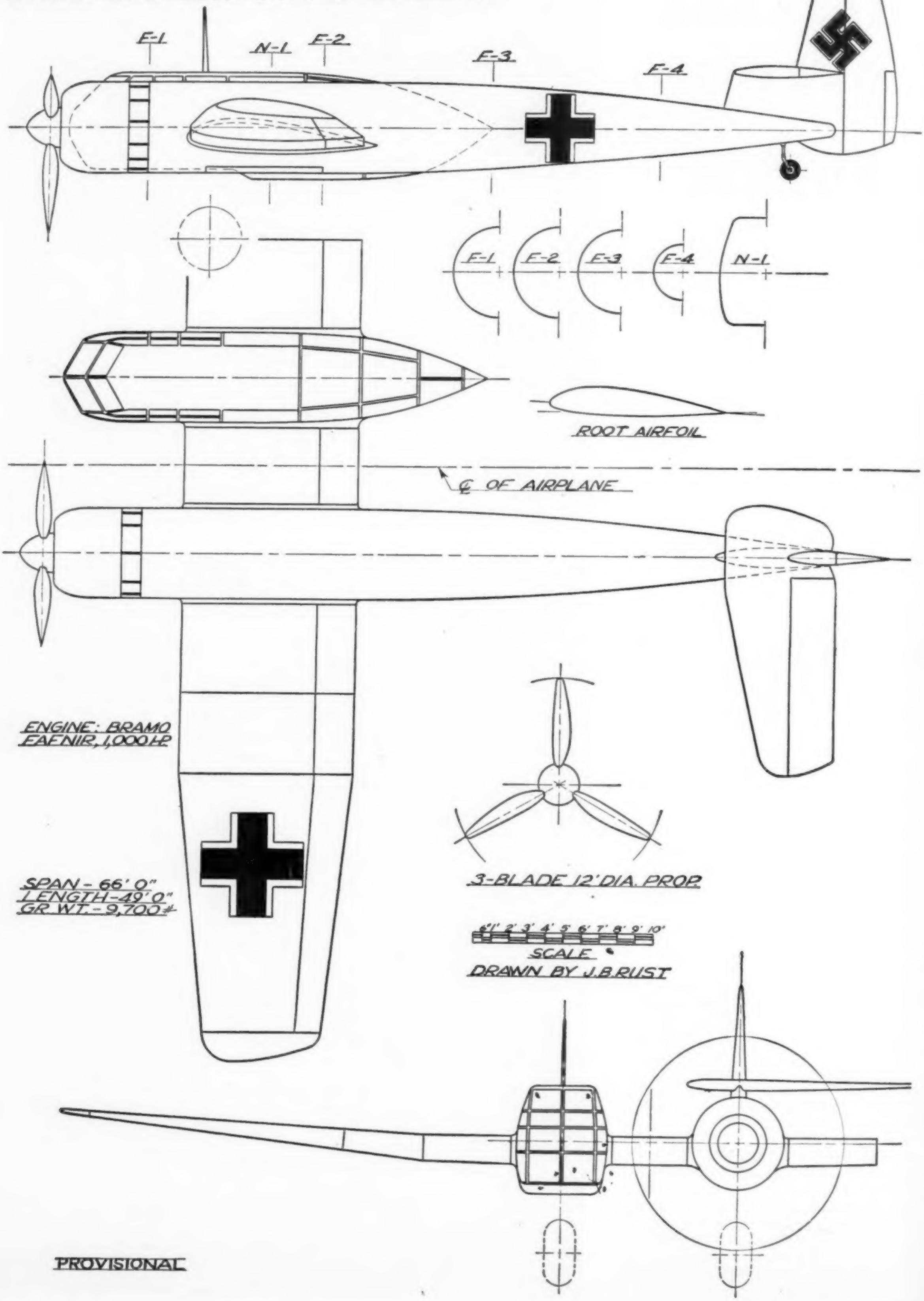
Design No. 1, to be considered, has been sent to us by Clifford Whiting. He has shown extreme ingenuity in handling and putting together the various required factors for a Prone Fighter; in fact, in most respects it is much superior to the Prone Fighter discussed in the May issue. Let us analyze its characteristics.

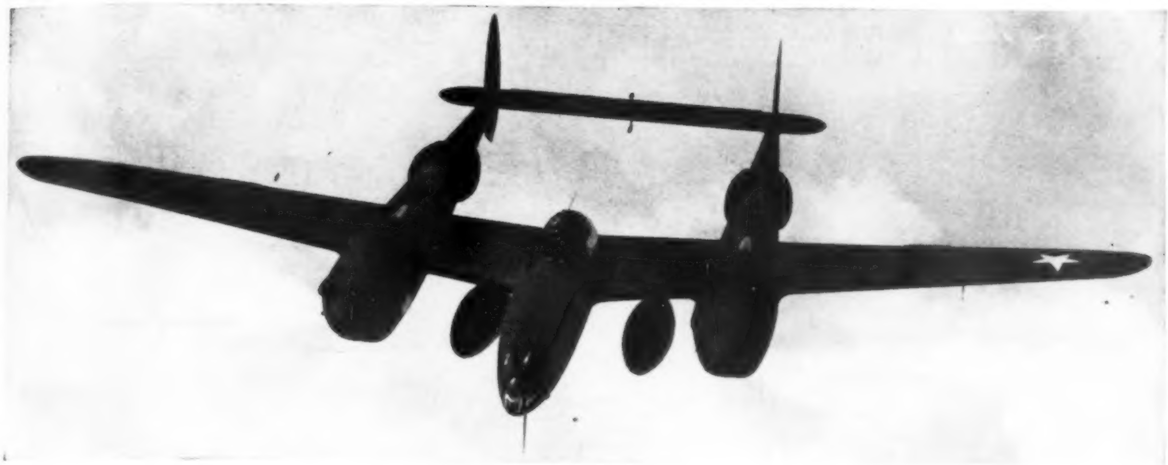
First of all, it has in part what is now considered a basic requirement for modern fighters, namely two propellers. It has definitely been found that in fighting on the front, pursuit pilots prefer to fly two-propeller fighters because there is greater assurance that they will return safely. However, two engines with two propellers are even better. Many instances have occurred where one engine has been put out of action and the pilot has returned home by means of the other. In a one-engine fighter the pilot would have been lost. So

(Continued on page 55)



Blohm and Voss Bv 141 OBSERVATION





WINGED LIGHTNING

The Plane on the Cover

The above picture shows the latest version of the Lightning fighter with new auxiliary fuel tanks for long distance flights. When empty they can be dropped.

FEW airplanes have so completely captured the public's imagination as has the Lockheed P-38 Lightning interceptor-pursuit airplane. Its twin booms, tapered wings and "pea-pod" fuselage has become as well-known in the average household as the telephone and toothbrush—and its exploits have become legend. But assuredly this fame is well-deserved for the P-38 is, indeed, a unique design embodying several features for the first time on its type. Some of our older readers may recall our introduction of this plane to the public way back in April and May of 1939 at which time the ship zoomed into the headlines with a cross-country dash from Los Angeles to New York which was marred by a crash at the eastern terminus of its flight. It may interest you to know that Lt. Benjamin Kelsey, pilot on that flight, is now Major Kelsey but only his rank has changed for he is still hard at work as an Army Air Forces test pilot. And the P-38 has undergone many, many changes, too, for, in addition there is now a special photographic version of the type.

The P-38 first saw action with the U.S. Army Air Forces in the Aleutian Islands attacking the Jap-held installations at Kiska and Attu and they scored repeatedly over Mitsubishi Zero fighters (MODEL AIRPLANE NEWS, January 1943 issue). With the Royal Air Force, where it is known as the Lightning Mark I and Mark II, it has distinguished itself in action over the Channel. In the South Pacific, where it has recently appeared, it has done valiant work against Zeros and other Nippon fighters but in Tunisia and Tripolitania in North Africa, the Lockheed P-38 has established itself most firmly in the hearts of Army Air Forces officers and men. Here it has proved its utility by doing duty as fast-climbing interceptors, ground attack machines, short-range bombers and convoy fighters. It has been used for reconnaissance photography and general scouting work. In short, it has done about everything a single-seat pursuit plane might possibly be ordered to do. But, above all, it has destroyed hundreds of enemy aircraft, both in the air and on the ground. So now, after exactly four years of development let's take a look at the Lockheed P-38, circa 1943, our Plane on the Cover this month.

Basically, it is an interceptor pursuit plane, designed tactically for interception of enemy aircraft. More specifically, it is designed to destroy enemy bombers at great heights and on short notice and this means: *Fast climb* and heavy *hitting power* and the P-38 is generously endowed with both these elements. Since a high rate-of-climb is a function of excess horsepower, it was decided to install *two* engines, rather than one, when this famed fighter plane was still in the design stage. A tricycle landing gear was chosen for ease of handling at comparatively high landing speeds which indicated a spacious nacelle area aft of the engine as well as a comfortable length of fuselage forward of the C.G. These things indicated the use of booms to support the empennage and the use of a simple "pod" type nacelle for the pilot, to provide for the heavy firepower demanded and the nose-wheel.

The wing is built in five sections; center section supporting the fuselage, two outer wing panels and two removable tip sections. It is built up on the single-spar principle with a light shear web serving to complete the structure box. Spanwise stiffeners support the wing skin and flush riveting is used throughout. In order to distribute the wing loads as much as possible at the joints, "bath-tub" fittings are laid into the corrugations between the main and rear beams with each fitting supporting a bolt. This corrugated skin lies underneath the surface skin, extending outward, carrying the majority of the torsion and shear loads. In this manner loads are carried across the joints in a well-distributed manner through a series of bolts rather than through only two or four.

Ailerons are all-metal, statically and dynamically balanced through use of lead weights bolted to the nose section. Both ailerons carry trimming tabs controllable, while in flight, from the cockpit.

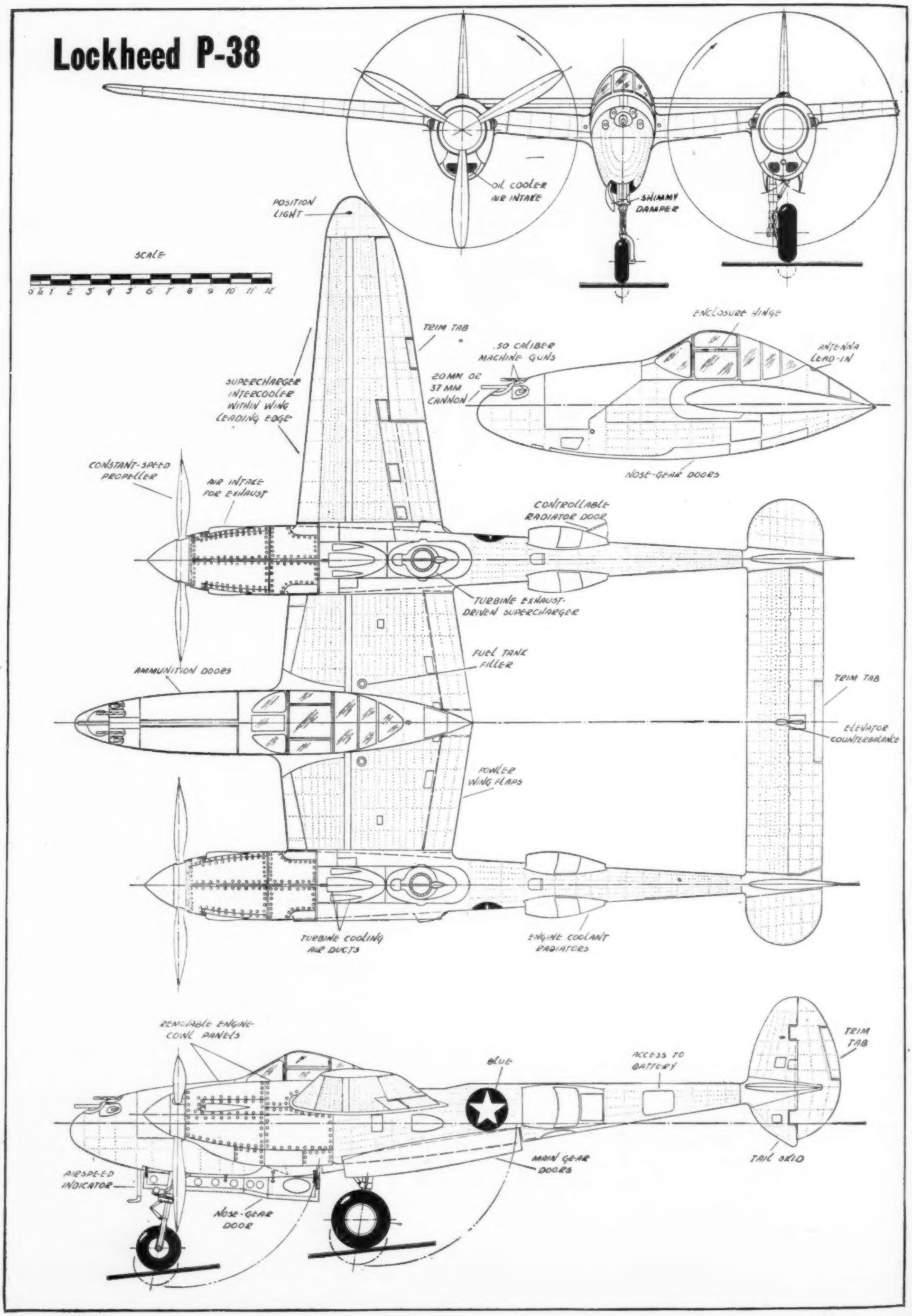
Wing flaps are the Lockheed-Fowler type which move rearward and down upon extension creating considerable additional wing area and increasing effective wing camber in such a manner that a great deal of additional lift is obtained when extended. Flaps consist of four panels, two beneath the trailing edge of the center section and one under each outer wing panel. They are hydraulically operated from the engine-driven hydraulic pumps and may be lowered by the emergency hand pump when required.

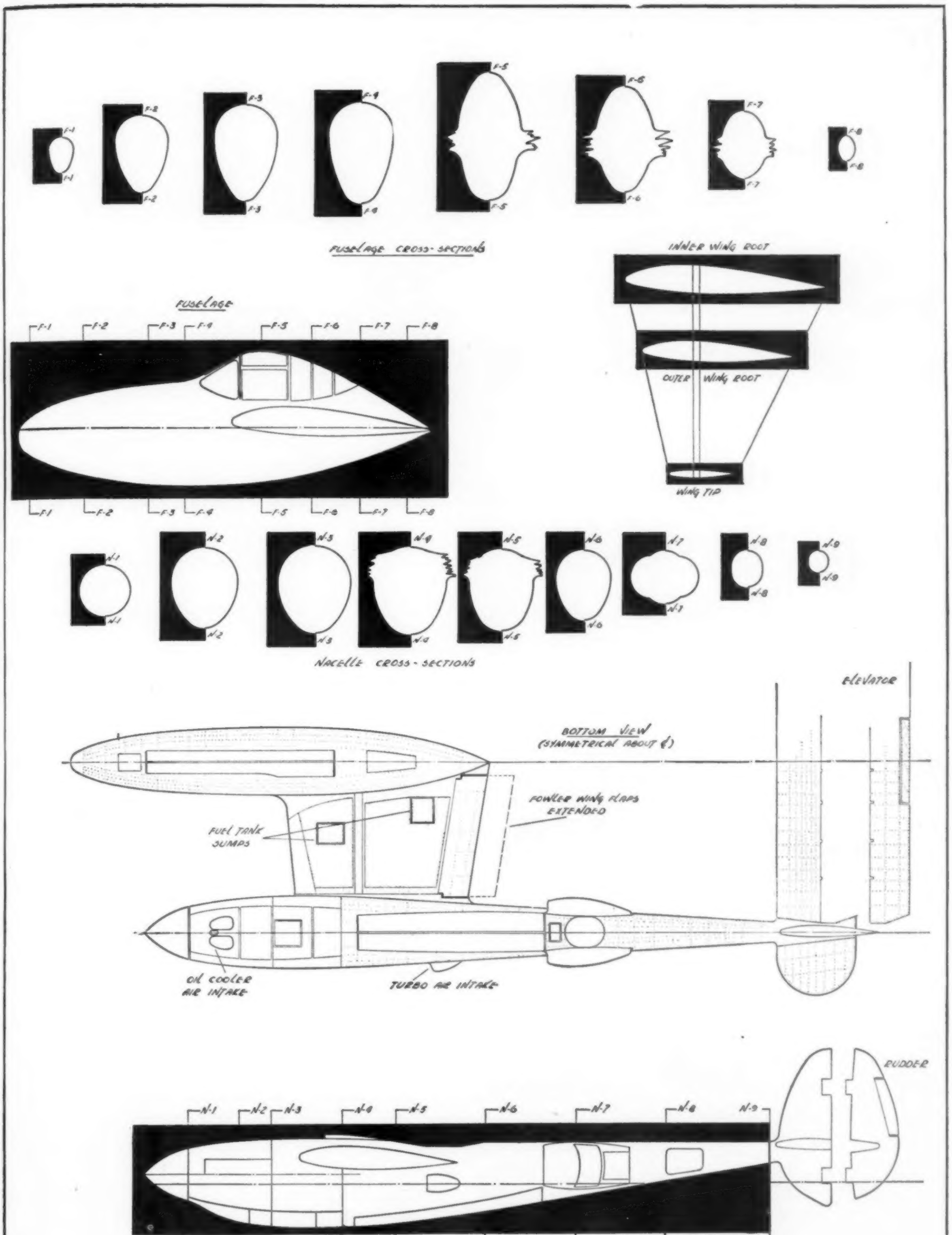
Booms are composite semi-monocoque construction being built up on a framework of frames and stringers covered with 24ST Alclad sheet. They are riveted with flush rivets, bolted to the engine nacelle through attach angles lying just aft of the main landing gear doors. The booms carry the supercharging turbines, parachute flares, batteries and baggage compartments.

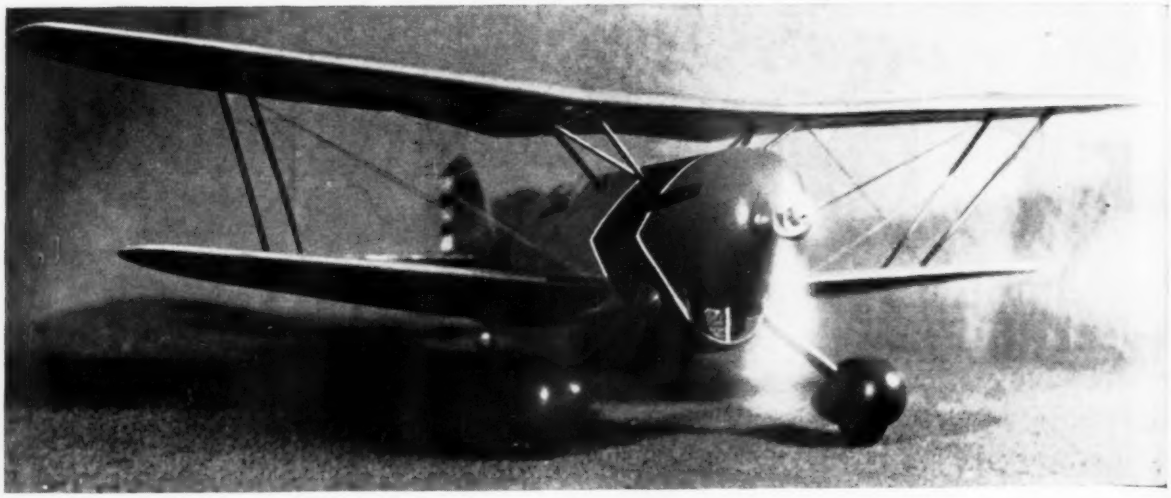
The empennage consists of two vertical stabilizers and two rudders, one horizontal stabilizer which completes the rectangle and the elevator. The movable surfaces are all-metal, statically and dynamically balanced through use of lead weights. The elevator static balance is the offset type, consisting of two large, streamlined lead weights supported above and below and forward of the hinge-line. The rudders and elevator have controlla-

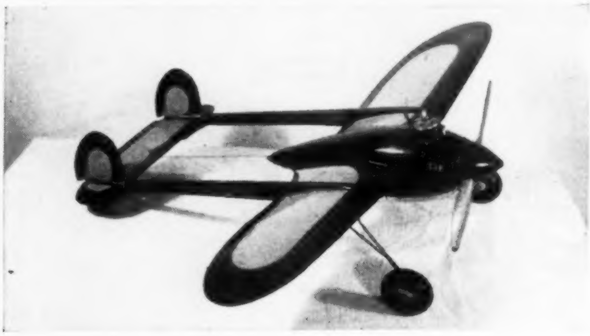
(Continued on page 51)

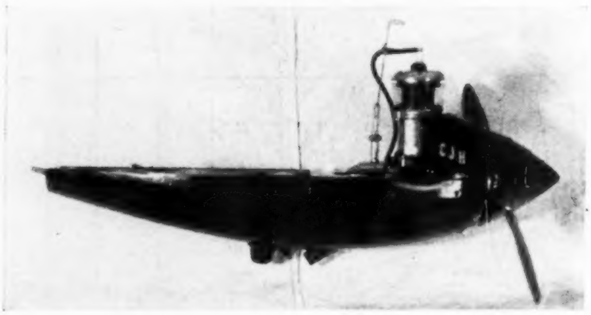
Lockheed P-38

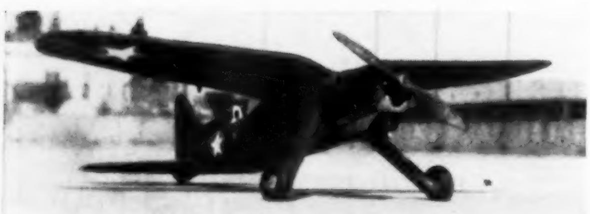



FUSELAGE CROSS-SECTIONS
INNER WING ROOT
OUTER WING ROOT
WING TIP
FUSELAGE
NACELLE CROSS-SECTIONS
ELEVATOR
BOTTOM VIEW
(SYMMETRICAL ABOUT ℄)
FOWLER WING FLAPS EXTENDED
FUEL TANK SUMPS
OIL COOLER AIR INTAKE
TURBO AIR INTAKE
RUDDER









AIR WAYS

News of model plane experimenters from all parts of the world

DUE to intensive work prompted by the Navy's model building program carried on in the schools throughout the country, a vast new crop of model building aviation students is growing up. Many of these have not reached the point where they build or understand the operation of flying models, having confined themselves chiefly to scale models, either solid or semi-detailed. The lack of participation of many in actual flying can be readily understood when it is realized that thousands of teachers of aeronautics classes knew very little of aviation themselves before this program was instigated. These teachers have to learn with the boys, so to speak, and if possible keep two or three jumps ahead of them.

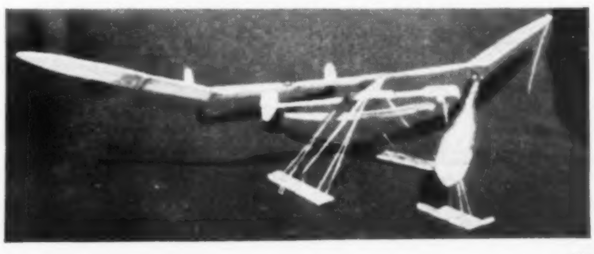
Many have attended classes in aeronautics to give them an insight into the science; a number have become interested from a personal standpoint in flying models. Pupils of such teachers are indeed lucky for they will be able to attain a broader aspect of model building, and to these we can look for some of our future experts. To the great majority, however, actually flying models is a mysterious proceeding and in fact appears so difficult that many hesitate to attempt building this type of ship.

Beginners, whether teachers or pupils, must start with the simple models if they wish to be assured of success and not such discouraging results from the first test flight that building a second model is never undertaken.

It is extremely important that teachers of such classes become proficient in flying models and we have several suggestions which may be helpful. One is they read the article entitled "Modeling the Future in Aviation" on page 29 of this issue, and the other twelve articles of this series published in preceding issues. This is a complete course in aeronautics for beginners, giving them a basic understanding of underlying factors of both large planes and models.

The second suggestion pertains more intimately to old readers of MODEL AIRPLANE NEWS, our expert model builders who have not entered the armed forces or taken a position in industry. These young men have been crying loudly and long for a way to help in the war effort, but either being under age or through other circumstances they have been unable to carry on in some vital war position. With this new group of young modelers growing up they can serve a vital need on the home front, by passing on their knowledge to

Top to bottom. Pg. 26. **1. Detail scale Curtiss Hawk P-6E by Paul Neck. 2. U-Control gas model with boom tail and demountable motor unit. 3. Motor unit detached from model. 4. Peter Westburg's beautiful semi-scale U-Control gas model. 5. A flying gas model P-47 pursuit with complete cockpit details.** *Pg. 27.* **6. This model, landing on a tinfoil sea with cotton spray, looks like the real thing, doesn't it? 7. A fine job of frame building and photography by Frank Gue. 8. The above model Curtiss SO3C-1 after it has been covered. 9. John Tatone's record breaking "gas hydro". 10. A tricycle "ski-gear" for winter takeoffs.**



teachers and the new group of students. If you are in a class taught by an aviation instructor, for instance, try to become his assistant. You can render him great service. You might even start a club in your school or class, giving talks to the members, having club contests and in various ways imparting your knowledge to your companions. You will have no greater satisfaction than being able to give basic training to future aviators in this way.

We would like to hear from those who act upon our suggestion and to know exactly what they are doing, or if they would like to start a club and do not know how to proceed, we will give them every possible advice if they will write to Airways Editor, MODEL AIRPLANE NEWS, 551 Fifth Avenue, New York City.

Possibly many model builders travel on buslines; you surely have if you have been a model builder for any length of time, for with the present gas shortage buses serve as the only means of transportation to contests for modelers. Some possibly have passed through Albany. If so, it is possible that one of our expert modelers, Paul Nock of 39 No. Pine Avenue, Albany, N. Y. has sold you a ticket for one place or another. Mr. Nock is head ticket agent for the Greyhound Bus Lines in Albany. He talks your language because he too is a model builder and is the proud parent of the Curtiss-Hawk P-6E shown in picture 1 on the top of page 26. So you see, as you travel around the country you never know whom you are talking to—perhaps every other man you meet is possibly a model builder.

The Hawk in the picture is certainly a realistic job and careful examination indicates expert workmanship. The tattletale marks in a scale model of this type are the brace wire attachments; a scale model may be beautifully built but the slightest bit of inexperience usually shows up when the modeler puts the wires in place. There is no evidence of inexpert workmanship here; in fact, it is difficult to tell whether or not this is a full scale ship or model. All the work is beautifully done. In most of his models, Mr. Nock uses 1/32" balsa wood for covering, finishing it off with fine sandpaper and four or five coats of either *(Continued on page 46)*

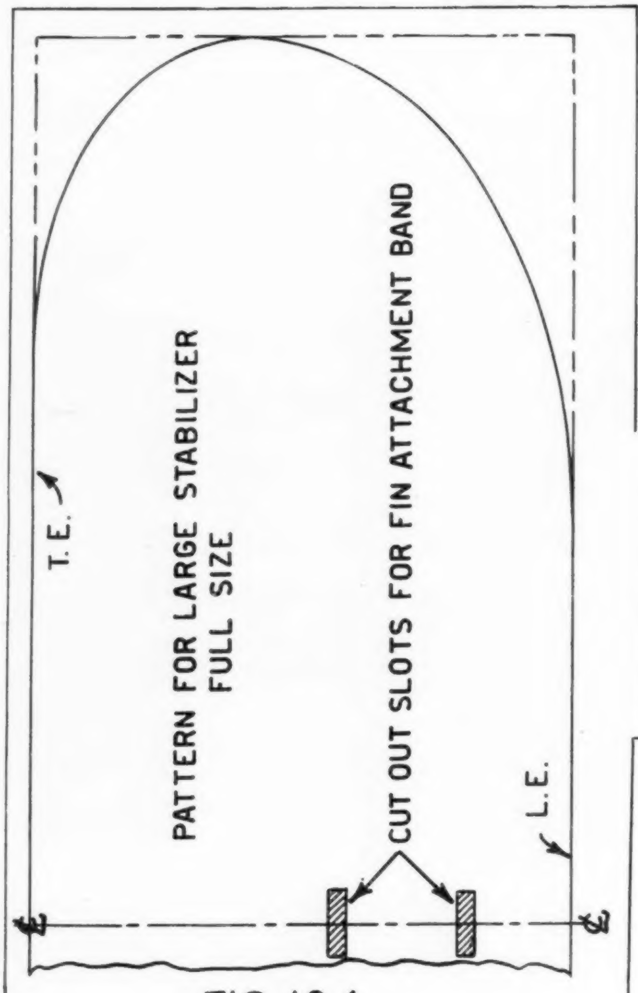


FIG. 104

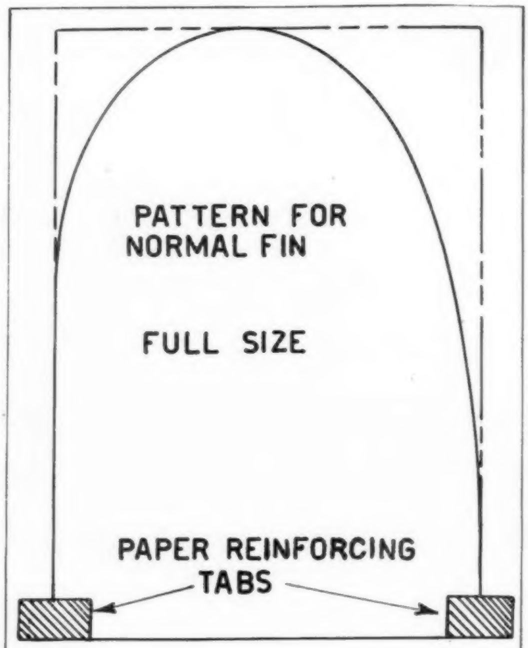


FIG. 106

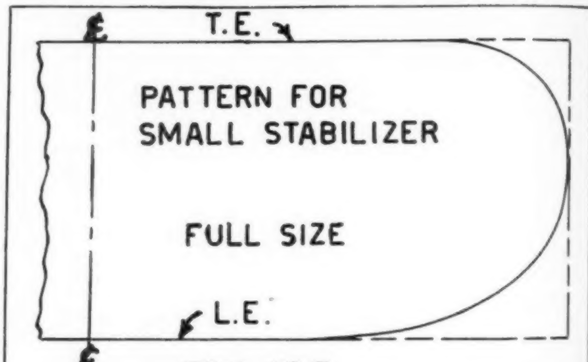


FIG. 105

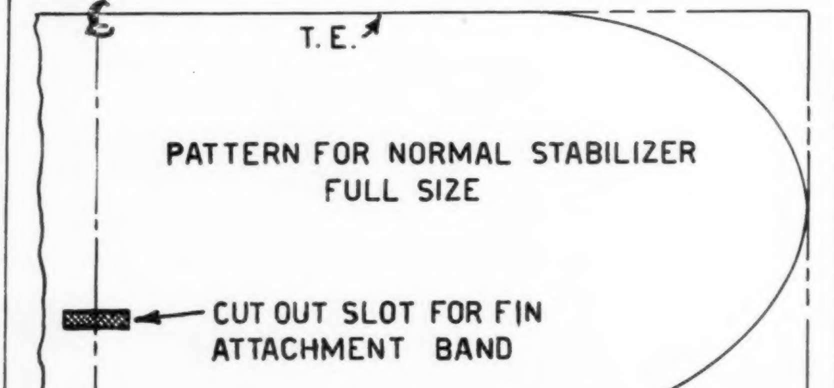


FIG. 103

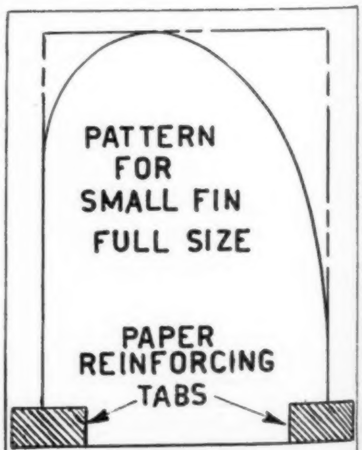


FIG. 108

MODELING YOUR FUTURE IN AVIATION

Lesson 13—Determining Tail Surface Effect by Experiment

Official Air Youth Course in model aeronautics

by CHARLES H. GRANT

THE origin of aeronautic science lies in experiment; every new development has resulted from a series of practical tests guided by knowledge gained from previous experiment. These of course are supplemented by deductions made from past experience and facilitated in their execution by knowledge of mathematics and science acquired through study.

Even new designs and developments in full scale aircraft spring from empirical data obtained from wind tunnel tests with models or full scale aircraft. Many gaps can be bridged with mathematical calculations but practical tests or experiments must be carried out to demonstrate the truth of envisioned possibilities.

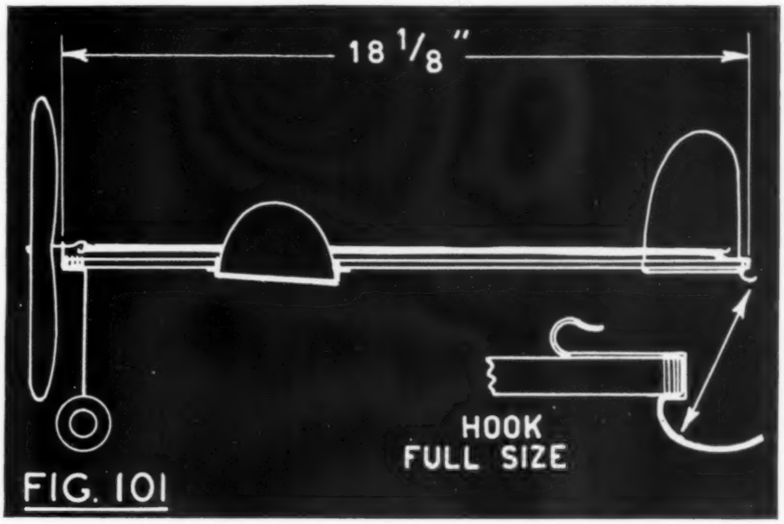
The model builder is indeed a fortunate individual, for he has within his grasp a means of obtaining vital aeronautic information and of pursuing a course of study through experiment, rarely possible in other branches of science. He can gain a broad knowledge of aerodynamics and general aeronautics merely by building and flying models in free flight. Of course careful observations must be made if he is to discover the secret of flight efficiency and stability by this means; two factors hinging upon the proportion and arrangement of the aircraft's features.

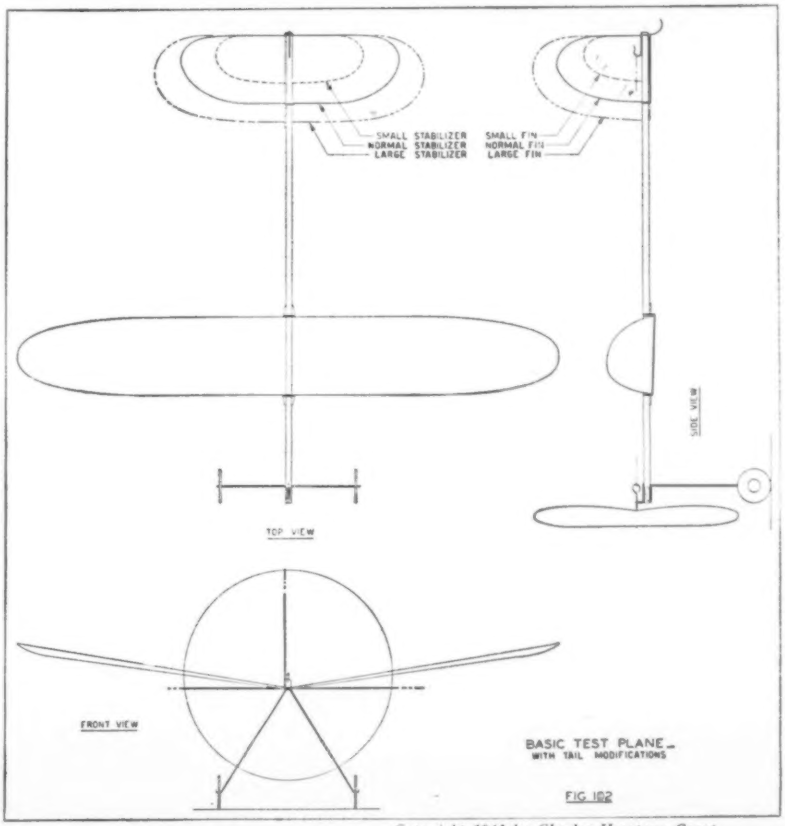
Unfortunately most arrangements result in inefficiency and unstable flight while only a few give best results. The problem is to discover the arrangement of features and their proportions that give the type of flight desired to the most efficient degree.

In preceding articles correct proportions and instructions for building and flying an efficient and stable basic test model were outlined. These proportions, through experiment, provide both efficiency and stability. So now we know *what to do* and many other models of this type may be built if desired. However, our present knowledge is limited to this one type. If other aerodynamic or structural types are to be built with specific degrees of efficiency and stability, it is necessary to know how and why various arrangements and proportions affect the flight of the airplane. These can be best determined by experimenting, trying one arrangement and then another. In this way the effects of the various proportions and laws governing them may be established. For instance, the effect of wing dihedral can be accurately determined, also the effect of stabilizer and fin size, wing angle or many other factors entering into airplane design.

By discovering the laws of proportion by experiment, experience will be gained that can be used in designing models or full scale craft for any specific purpose or type of performance.

Now suppose we embark upon our career in experimental aviation. Having built and flown a basic test model, you have a standard of performance with which performance of future test models can be compared.





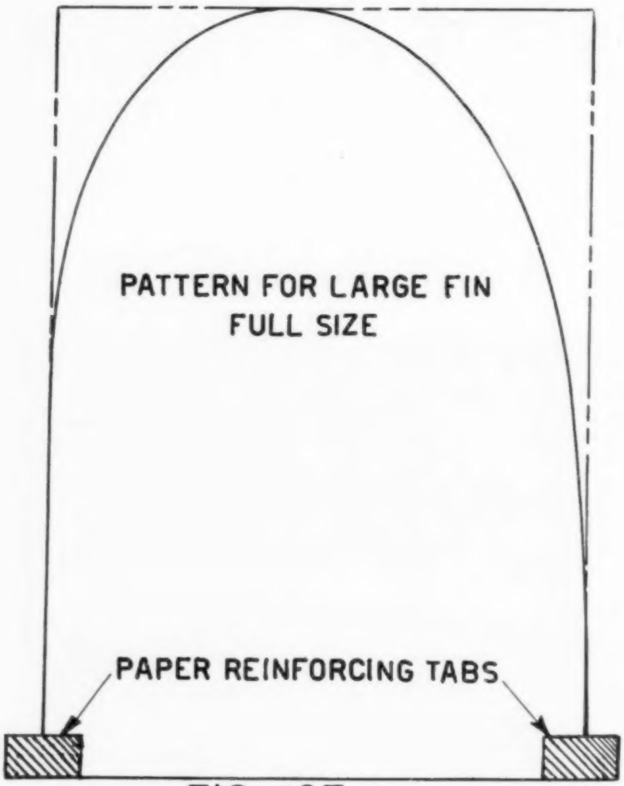
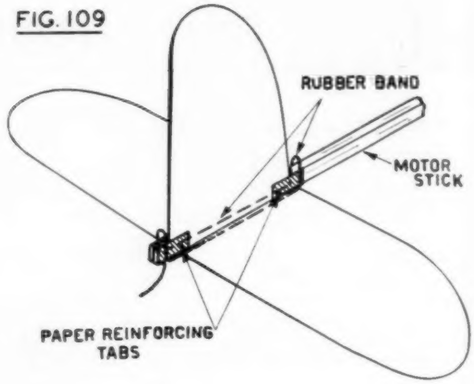


FIG. 107

FIG. 109



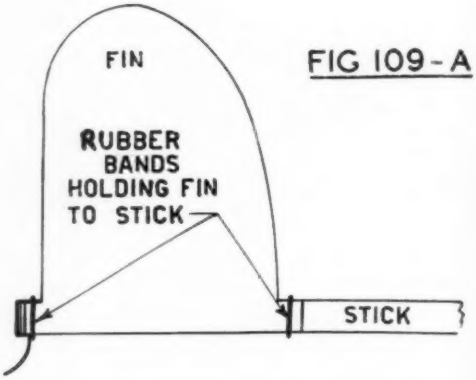


FIG 109-A

To carry out these tests a second plane should be constructed; it is unwise to use the basic test model because this should always be kept handy for reference and possible future flights to serve as a means of comparison. So construct a second model to be used purely for testing purposes, built like the basic plane in all respects except that construction must be modified so changes in proportion and arrangement can be made quickly.

In order to embody these modifications in the second test plane, the nature of the tests must be known. Tests may be classified under two general headings: those which pertain to efficiency and those that pertain to stability. A model builder is most concerned with stability because efficiency cannot be demonstrated unless the model is completely stable and can fly without crashing. The pilot in large planes controls the aircraft and makes any required corrections in flight; however, a model must fly without the guidance of a pilot and this is only possible when it is stable.

So our first experiments should be carried out with the idea of discovering all the essential laws of stability. It is natural to start with the most important factor—that which affects the flight of a model plane to the greatest extent—namely the tail surfaces: their sole purpose is to provide steadiness and stability in flight. So build the test model exactly like the basic plane except for the tail surfaces and tail skid.

The tail surfaces must be detachable because if we are to determine their effect, a series of different designs must be tested. The size of surfaces has the greatest effect upon stability, so to quickly attach or detach fin and stabilizers of various size combinations they must be made as separate units.

Fig. 101 shows a side view of the model and indicates the type of skid that should be used. This allows the stabilizer to be fitted up against the underside of the stick directly in front of it and the fin to be attached to the right side without interference from the rubber motor.

A model builder can logically ask why a small or large stabilizer cannot be used and still retain stability; it is obvious that the larger the stabilizer the greater drag it will have and the less the resulting efficiency—so from an efficiency standpoint the stabilizer should be small. However, to fully understand the effect on stability tests should be made with both a large and small stabilizer to compare results with performance given by the normal size stabilizer of the basic test model. Thus a difference in flight can be easily observed and effect noted.

So tests will be carried out with two sizes of stabilizers and fins; these are indicated in dotted lines in Fig. 102, showing a three-view of the basic test planes in heavy lines.

To make the surfaces detachable they must be designed in a specific manner. Three sizes will be required. Fig. 103 shows a pattern for half the normal-size stabilizer; Fig. 104 for the over-size stabilizer; Fig. 105 for the under-size stabilizer. Figs. 106, 107, 108 are patterns for the normal, over-size and under-size fin, respectively.

You will note a slot cut in the stabilizer for the fin attachment band. Cut out these surfaces from 3/64" balsa sheet, or, if hardwood is used, make cut-outs similar to those indicated on the plans for the basic test model, given in Article 11, May issue. Then cover with light tissue paper on both sides.

The stabilizer is similar to the basic model stabilizer except that slots for the fin attachment band, as indicated in Fig. 103 and 104, are cut out at the center. This is necessary because the fin must be made separately from the stabilizer and held in place with rubber bands. These bands fit into these slots when surfaces are assembled and thus the stabilizer can contact the underside of the stick throughout its full width without distortion.

The shape of the fin is similar to the basic plane except for small ears protruding at its lower edge, front and back. The balsa should be cut to the outline of these ears and then reinforced on both sides with paper, as indicated. This will prevent the ears from splitting off.

When assembling the tail surfaces first attach the fin to the right side of the stabilizer, as indicated by Fig. 109A. Small rubber bands should be looped around the stick; then when the fin is slipped in place the rubber bands can be slid along the stick and over the fin ears, thus holding the fin tightly in place. To assemble the stabilizer, loop a rubber band around the fin, then draw the band down on each side of the fin below the stick so there is space between the band and bottom of the stick. Pass the

stabilizer through this space between band and stick and release the band. Fig. 109 shows this method of attachment.

When the stabilizer is centered carefully, it is ready for flight. If corresponding size fin and stabilizer are used, the fin attachment bands will be forward of the stabilizer leading edge and to the rear of its trailing edge. However, when small fins are used with large stabilizers, fin attachment bands should fit into the slots cut in the stabilizers.

After you have constructed your tail surfaces and are thoroughly familiar with the method of attachment for the various combinations, you are ready to carry out your first test in aerodynamics. The first step is to fly the plane with normal stabilizer and fin, determining correct position of the wing for proper balance in normal flight; the flying procedure is the same as in the case of the basic test plane. Then when the model is properly adjusted, various size tail surfaces are applied and their effect noted.

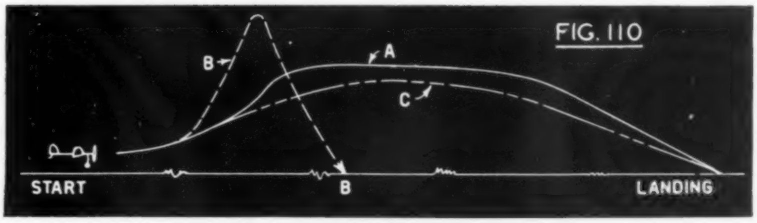
Flying with the large stabilizer and the normal fin constitutes test No. 1. Before changing from normal to large-size stabilizer, however, determine the center of gravity of the model carefully and mark a line on the stick at this point and also the wing position. Then replace the normal stabilizer with the larger one and test the plane again.

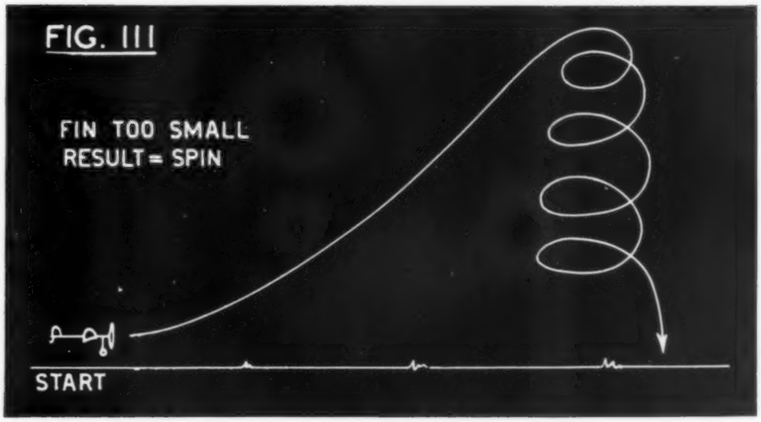
Probably it will be changed slightly due to the heavier tail surface; it is essential, however, for test purposes that the balance be absolutely unchanged. So bind a small weight, such as a piece of wire, to the underside of the frame stick at the nose, adjusting the size of this wire by trimming or enlarging until the model with the large tail surface balances exactly the same as with the normal tail surface. This point of balance should be directly under the line drawn on the stick.

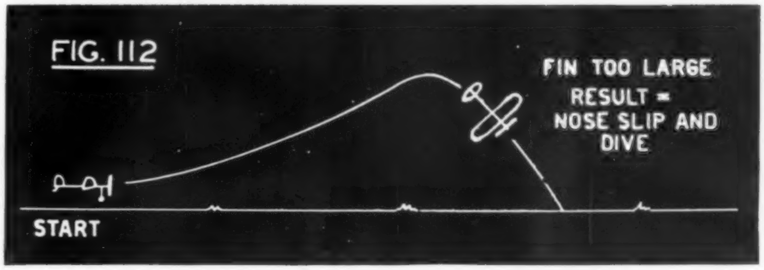
Now you are ready for your first test flight. With this unchanged balance any resulting change in flight will be due solely to the effect of larger stabilizer area. Wind your model and launch it in the same manner as the basic test plane, noting carefully any change in type of flight. Undoubtedly there will be considerable difference.

If the plane has been adjusted for a steady climbing flight with the normal stabilizer, you will see immediately that with the large one, climb will not be quite so steep but will be much smoother; in fact, do not be surprised if the ship climbs hardly at all. The effect usually is to smooth out all climbing and diving maneuvers; whereas with the normal ship the climb would be fairly steep and the recovery at the crest quite abrupt. With the large-size stabilizer recovery will take place with unbelievable ease and grace; in fact, there will be no definite point of recovery but a comparatively smooth flight arc, as shown in C, Fig. 110; A indicates the flight course of a normal plane.

Do not be disappointed if the model flies in a comparatively horizontal course with a steep glide at the end; this merely indicates that the wing adjustment must be changed, the center of lift being moved forward relative to the position on the normal basic test model. When large stabilizers are used, the wing must be moved







forward ¼" to ½" to obtain the same angle of climb and general flight characteristics as the normal plane. So move the wing forward ¼" for the second test flight. Note carefully the difference in performance; the climb will be steeper and the glide flatter. Then in the third flight move the wing another ¼" forward, a total of ½" from the original position. Then fly it again. Proceed to do this until the ship stalls.

With each succeeding flight and change of wing position you will be impressed with the amount that the wing can be moved forward or backward with little effect on the longitudinal balance; so your first deduction can be made and established as a basic law: the larger the stabilizer in any given plane the more stable and less critical it will be longitudinally. In other words, the model does not have to be so delicately adjusted and balanced.

On average models the wing must be placed in a definite position to obtain best results; sometimes even a slight move forward or backward from this point will cause considerable disturbance in longitudinal balance, making the plane unstable. However with a large stabilizer this movement may be considerable before the point of instability is reached. From this it is evident that, especially for beginners' models, that large stabilizers should be used because careful adjustments are not necessary to obtain successful flights.

Possibly the difference in flight between the normal and large stabilizer may not be extremely marked. However by testing the ship with the small-size surface, given in Fig. 105, difference in flight should be so great that even the beginner can not fail to note it.

So for the test flight series No. 2 replace the large stabilizer with the small one, using the normal size fin. Follow the same procedure as on previous test flights: first place the wing in the position for correct flight with the normal tail surfaces, then balance the plane. The stabilizer being lighter than normal, the nose will be heavier, so the weight previously attached to the nose must be fastened to the underside of the stick immediately in front of the tail surfaces. Move this weight backward or forward as required to give normal balance. Test flights are then undertaken.

If all adjustments are just right, the plane may make an excellent flight; however the chances are it will not fly at all, or for only a short distance in an erratic manner. The tendency will be to follow course B, Fig. 110. As you watch the little ship after launching, it will start out steadily, gradually climbing to a fairly steep angle until the stalling point is reached, and then in-

(Continued on page 61)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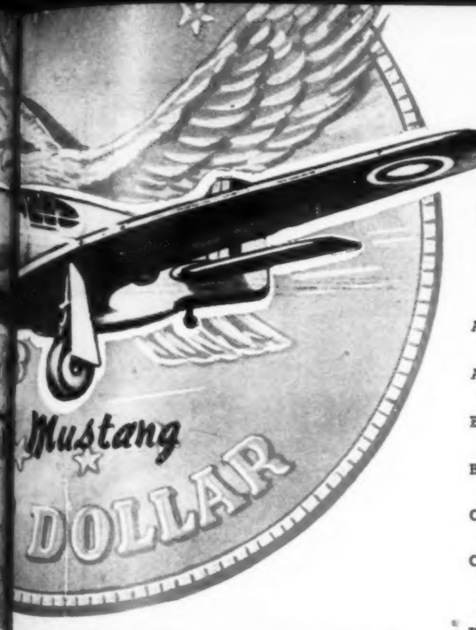

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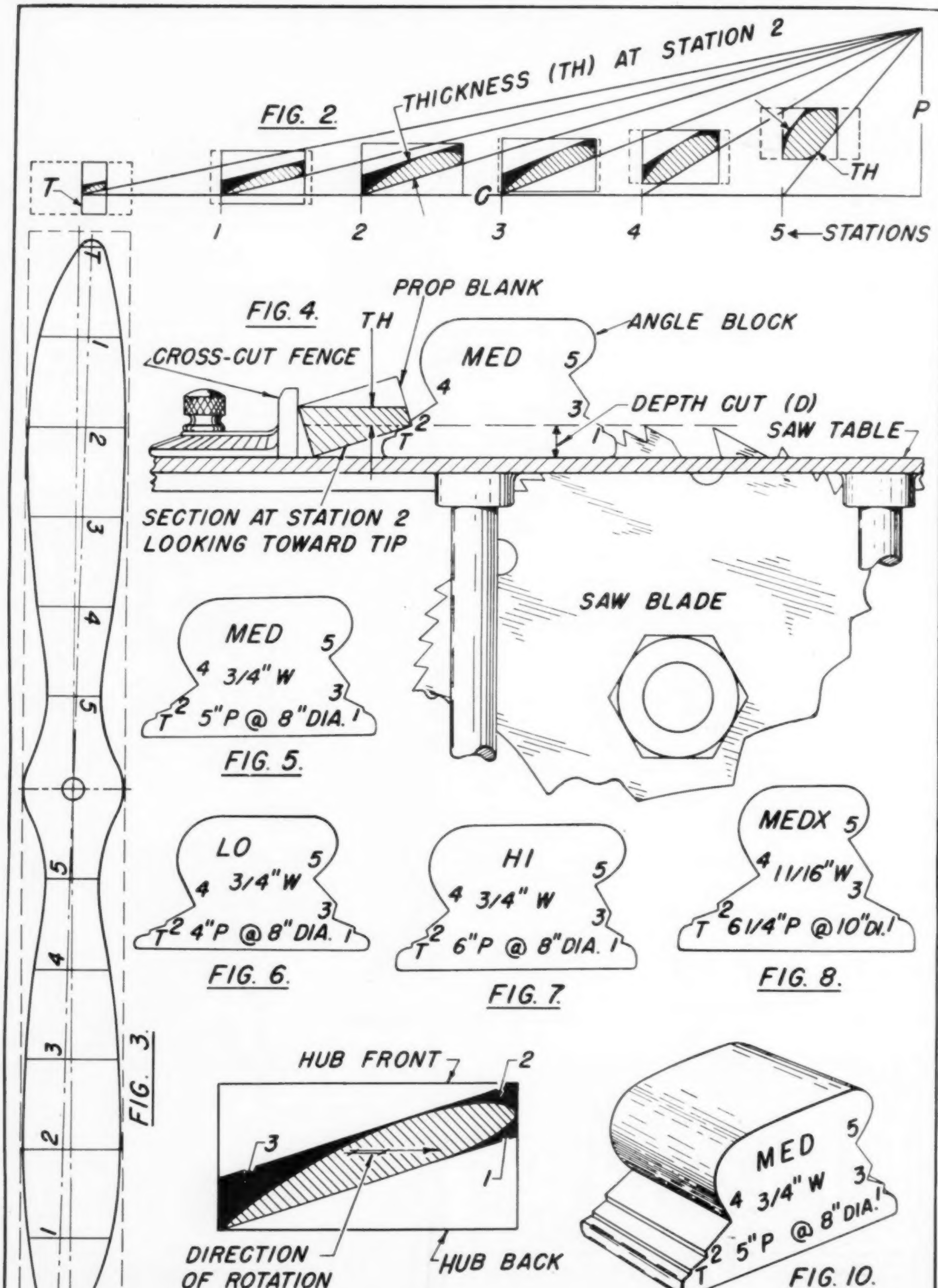
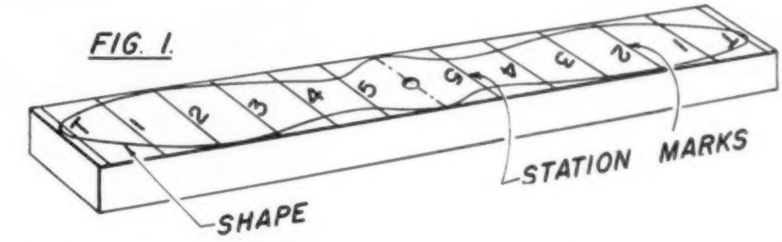


FIG. 2.
THICKNESS (TH) AT STATION 2
P
T
C
TH
1
2
3
4
5 ← STATIONS
FIG. 4.
PROP BLANK
TH
ANGLE BLOCK
CROSS-CUT FENCE
MED
5
4
3
2
T
1
DEPTH CUT (D)
SAW TABLE
SECTION AT STATION 2
LOOKING TOWARD TIP
SAW BLADE
MED 5
4 3/4" W
3
T 2 5"P @ 8" DIA. 1
FIG. 5.
LO 5
4 3/4" W
3
T 2 4"P @ 8" DIA. 1
FIG. 6.
HI 5
4 3/4" W
3
T 2 6"P @ 8" DIA. 1
FIG. 7.
MEDX 5
4 11/16" W 3
T 2 6 1/4"P @ 10" DI. 1
FIG. 8.
FIG. 3.
D
HUB FRONT
2
3
1
DIRECTION
OF ROTATION
HUB BACK
FIG. 9.
MED 5
4 3/4" W 3
T 2 5"P @ 8" DIA. 1
FIG. 10.
FERRÉ

ACCURATE PROPS IN A JIFFY

A simple method of laying out and carving accurate gas model propellers of any desired pitch, diameter or shape

by **RAY RUSHER**



NOW that war makes gas model propellers hard to get, some of you modelers may be interested in a quick, easy way to "carve your own." The writer worked out a method which has proved very satisfactory, and insures an accurate shape for all parts of each blade. Four representative propellers are here described; others can be worked out by you after understanding the principles involved. An 8" prop with a 5" pitch has been selected as the main example. Instead, you may wish to follow the design of one of your favorites which has given exceptionally good performance.

Briefly, the procedure is to provide a blank with cross-slots of proper angle and depth at stations spaced the proper distance from the hub so that five minutes of carving with a jack-knife results in a rough carved prop having correct thickness and twist throughout each blade. Blades may then be finish-carved to the desired airfoil section and sanded to secure a smooth finish.

Blanks of gum wood, pine, mahogany, walnut, ash or other suitable wood are first accurately sized as to crossection. The size for our 8" prop is 3/8" x 3/4" x about 1/4" longer than the desired prop diameter. The range may be 6-1/4" to 9-1/4" for a blank of this crossection. The prop shaft hole is first centered and drilled; be sure it is square with the front and back surfaces of the blank. The stations T, 1, 2, 3, 4 and 5 are then penciled across the back of the blank at six equally spaced points from center to tip (T) of each blank half. Next pencil the shape of the blades on the blank; the blank will then appear as in Fig. 1. Any of the several shapes found in gas model props may be used, as suits individual preference. Fig. 3 is a full-size pattern for an 8" prop suitable for an Atom engine. Glue the pattern to a piece of cardboard, cut it out, and use it as a marking template.

You are now ready to cut the cross-slots. These are preferably cut on a small (4") circular saw, although a miter box can be arranged to do the job. Prime requisites are accurate angle and depth of cut at each station. The angle of the cut of each cross-slot is determined by a layout, as shown in Fig. 2, the basis of which is a circumference line (C), a pitch line (P) and six equally spaced stations, T, 1, 2, 3, 4 and 5. The length of C = Prop diameter in inches times π, and the length of P = Pitch in inches. (Any scale may be used, Fig. 2 being 1/4.) The blade angle at each station is then determined by a line drawn from the station to the top of the line P. From the layout of Fig. 2, the proper shape for an angle block (Fig. 10) may be determined.

The angle block is then cut out on a jig-saw. In Fig. 5, 6, 7 and 8 four patterns are given. The patterns may be cut from the drawing and glued directly on a block of wood 3/4" or 1" thick, or the shape traced on the block. Of these four patterns, MED is full size for the medium pitch prop here used as our main example, and can be used for any one of the 6" to 9" sizes. LO is for props of similar diameter and less pitch, HI is for one of similar diameter and greater pitch, and MEDX is for a prop 1-1/16" wide and of 10" to 13" diameter. MEDX will produce a pitch of 6-1/4" on a 10" prop. The four angle block patterns here given will produce props of the specified pitches at the diameters indicated below:

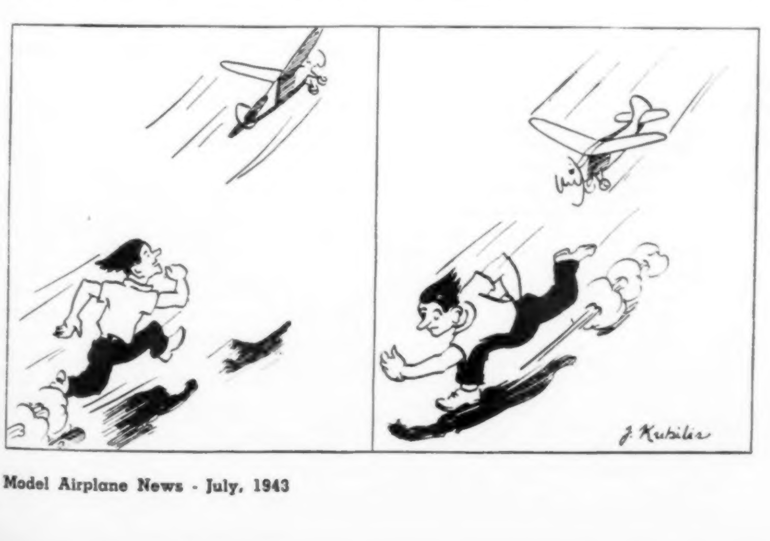
Dia.	6	7	8	9
P of LO	3	3-1/2	4	4-1/2
P of MED	3-3/4	4-3/8	5	5-5/8
P of HI	4-1/2	5-1/4	6	6-3/4
Dia.	10	11	12	13
P of MEDX	6-1/4	6-7/8	7-1/2	8-1/8

By holding the angle block down against the saw table about 1" to the right of the saw blade, and with the blank tilted on the angle block as in Fig. 4, cross-slots at a given station may be cut. Be sure to hold the forward lower corner of the blank snugly in the proper notch of the angle block; the rear lower corner against the top of the saw table and the rear upper corner against the cross-cut fence. First, cut a cross-slot in the front of the blank in line with the station mark on the back, then cut a cross-slot in the back in line with the slot just cut. The other blade is then similarly cut. The saw table, of course, has to be set for the proper depth (D) of cut at each particular station, as shown by the following chart:

Station	T	1	2	3	4	5
Th	4	7	8	9	12	17
D—LO	13-1/2	12-1/2	13	14	15	16-1/2
D—MED	14	13-1/2	14	15-1/2	16-1/2	17-1/2
D—HI	15	14-1/2	15	16-1/2	17-1/2	18
Th	4	8	10	12	16	22
D—MEDX	20	19	20	21-1/2	23	25-1/2

The depth of saw cut and the thickness (Th) of the blade are given in 64ths of an inch. Some of these depths it will be noted are the same, so that the slots at these stations can be cut with the same saw setting. D in each case has been calculated so that about 1/64" is left for finish carving and sanding. Trial cuts at the depths indicated on the chart should be made on scrap pieces of blank stock. You may find that Th varies at the different stations with respect to the above chart when you caliper the thickness of the scrap piece. If so, it is due to inaccuracies, as when sawing out the angle block. If the variation is not more than 1/64" or 2/64" make a corrected chart of your own to fit each particular angle block, with D changed where necessary to get the proper Th at each station.

(*Continued on page 40*)



A front view showing the "V" tail and thick wing

Bird Wing Gas Model

(Continued from page 16)

times, using thin dope to begin with, and apply ten coats at the nose, where oil accumulates. Color scheme is left to the individual builder; however the fuselage side view shows the color outline used on the original. Now cut out mounts, drill the necessary holes to accommodate your particular motor, bolt to bearers, and mount motor. Solder wheels to axle, install tail hook, and fuselage is completed. Now you might give in to that inevitable craving and run your motor to reassure yourself that ignition is O.K. and motor still revs.

WING: Choose a good quality quarter-grain 3/32" wood for ribs (use medium 1/8" if a good quality 3/32" isn't available). Cut out and sand to a smooth finish. Cut out wing tips. Select and cut to length spars, leading and trailing edges. Block up lower spars to compensate for undercamber in airfoil. Lay out and glue ribs perpendicular to spars. Next add leading and trailing edges and top spars, and tips. Tip ribs may be cut and sanded to rough outline. When thoroughly dry cut tips, leading and trailing edges to a streamline shape with less undercamber than regular wing ribs. Then sand completely, making sure the tip ribs are of correct shape, and glue well.

Dihedral may be put in now. Fill in space between spars with a solid block of medium wood. Glue 1/16" or 3/32" plywood to spars, and if additional reinforcement is desired, attach another hardwood brace to the other side of the spar.

Repeat entire procedure for second half.

Join the two panels by blocking up one or the other 6" at the tip dihedral joint. When dry reinforce joints in manner described above. Now reglue entire wing, giving strategic points of the wing extra coats of glue. Now finish sanding wing with fine sandpaper and wing is ready for covering.

The tail is built in the same manner as the wing. Now cover wing and tail. Be sure to glue covering to ribs on bottom of wing. Use thinned out dope for the first two coats; apply six to eight coats. Wing and tail need not be colored if extreme lightness is desired. Glue block of wood to tail at its center dihedral joint and sand to a smooth streamline shape. Model is ready to fly. Now to enjoy the fruits of your hard labor!

FLYING: Adjusting your model is simple, and even a beginner will have no trouble. Original flew with predetermined adjustments and required only minor changes. However, in spite of simplicity of initial adjustments, employ great care and time in perfecting them. A noted model authority has said: "A good flight is comprised of 50 per cent design and 50 per cent adjustments." Your success in the flying of this model is directly proportionate to the care and time put into the building and adjusting. The model flies left under power and left in the glide. It is not sensitive to rudder, so the tail may be moved 1/8" at a time, until the proper circle under power and in glide is obtained.

With a little care and prudent judgment, the plane will give its owner more than one season of profitable and enjoyable contest flying. Its sturdy construction will also permit a good deal of sport flying. So—out to the flying field, and thrill to the performance of the Bird Wing Gas Model.

VICTORY

Train With This Navy Trainer

(Continued from page 9)

fuselage out of line. Place the remaining stringers, cutting notches as required with a sliver of razor blade. Once a stringer is attached to one side always place another in the corresponding position of the other side. After the stringers are all attached the temporary brace at the cockpit is removed.

The engine cowl and top of the fuselage back to the cockpit are covered with 1/32" sheet balsa. Make a paper pattern of the cockpit shape and cut the sheet balsa accordingly before cementing in place. Pins and rubber bands will help keep the sheeting in place until cement is dry.

The cowl front is made from three discs

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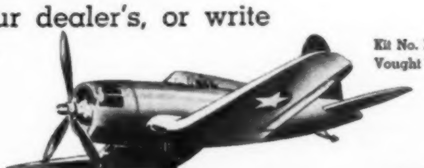

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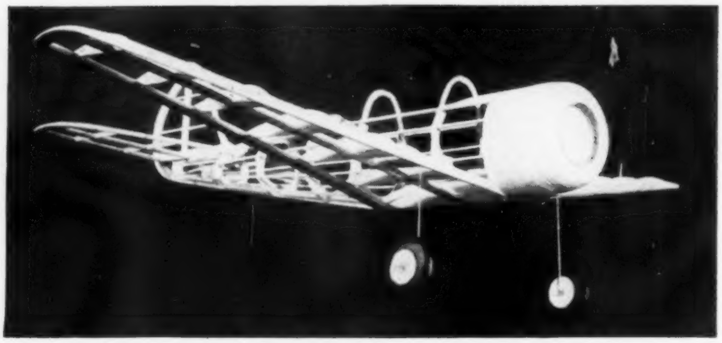
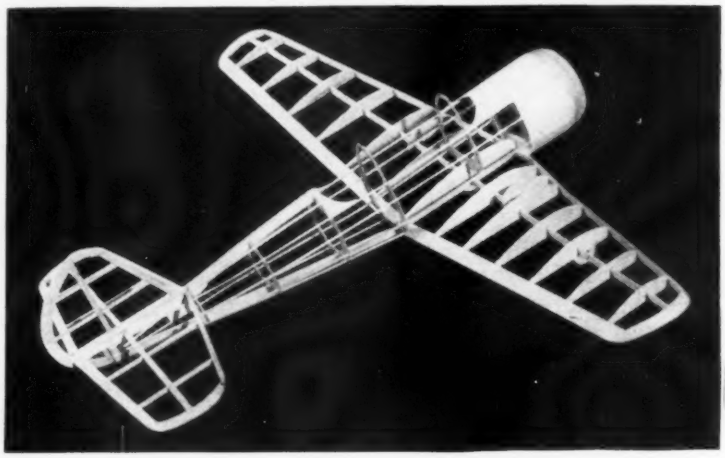


The complete framework ready to cover is ingeniously simple yet very strong. A light tail gives it excellent balance



of 3/16" thick balsa which are cemented together. The back disc, adjacent to bulkhead A, is solid except for the 5/8" hole for the nose plug. The other discs have the centers removed to the extent indicated in the plans. Cement together with the grain of each opposite that of the adjacent discs. Attach the unit to the first bulkhead and, when dry, roughly cut to shape. Finish by sandpapering the cowl and sheet balsa covering. The removable nose plug is made from hardwood as shown and is made to fit neatly to the crankcase which is cemented within the cowl front.

For those builders using white pine or basswood it is suggested the same construction procedure be followed but bulkheads of 1/32" or 1/20" thickness should be sufficiently strong. Make stringers of 1/32" x 1/16" size placed with the narrowest side next to the covering so they will be about the same strength and weight as balsa. If this size stringer is not available, 1/16" sq. stock sanded slightly smaller will be all right.

TAIL SURFACES: Construction of tail surfaces is very simple. Both the stabilizer and rudder are built in a similar manner. In the interest of greatest strength the stabilizer is built in one piece. Outlines are cut from the required stock and the flat frames are built directly on the plans. After the cement has set remove from the plans and with razor and sandpaper trim the leading and trailing edges to an airfoil shape. Check for warps.

If it is necessary to use hardwood other than balsa for the tail surfaces, it must be remembered that they must be of light yet strong construction. To accomplish this reduce the size of the various parts and be sure to cement all joints well so there will be little tendency to warp.

WING: It is necessary for the wing to be of strong construction since the landing gear is attached to it. Make a right wing plan so that both wing halves can be assembled directly over the full size plans. Two of each type rib with the exception of No. 1 are required; all are cut from 1/16" sheet balsa. Cut notches for the spar with accuracy to insure a neat job. Taper the trailing edge to the required crossection before pinning in place over the plans. Assemble the parts right over the plans using pins to hold them in place until cement has set. Tips are cut from 1/8" sheet and are now cemented in place. Trim the edges and tips to shape, finish with sandpaper and then solidly join the two wing halves together with 2" dihedral under each tip.

To keep the weight at a minimum the builder using heavier wood will have to use material of smaller crossection, particularly the leading and trailing edges. Ribs should be cut from the thinnest stock and lightening holes at points of little stress will reduce the overall weight.

A landing gear of the type used on the model SNC-1 is very rugged yet accurate

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in appearance. It is easily made from .040 music wire. The top of each strut is bent in such a manner as to join the spar and run along the false rib. Be sure to make a right and left strut. Using thread bind the wire struts to the spar and then use a needle and thread and sew right through the balsa rib and about the wire. Strengthen the whole area by applying several coats of cement. The rubber tubing (or any other kind of flexible tubing) is not added until the wing is covered.

Make the wheels from laminated discs of balsa or they may be purchased at your local shop. Cement bearings to the sides so they revolve accurately and smoothly.

PROPELLER: For best performance any flying model should have an efficient propeller. Select a balsa block 1" x 1-1/2" x 7-1/2" and cut the blank to the shape shown. Drill the tiny hole for the prop shaft. Then start to carve a right-hand prop. Finish the back surface of the blades first, then cut away the front to the desired thickness. Round the blade tips similarly to the prop in the photos. Use rough and then fine sandpaper to smooth and balance the blades. A free-wheel device should be attached to improve the glide and a bearing cemented to the back so the prop will revolve smoothly. Apply several coats of clear dope with light sanding between each and then color dope to a nice finish.

The removable nose plug is shown in the side view. This is carved from a hardwood block to required shape. Flight trials of the test model indicated that several degrees of right thrust but no down thrust is required, so this can be incorporated in the plug at this time. Fix the thrust line by cementing washers to the front and rear of the plug.

For the propeller shaft use .040 music wire. Place several washers between the prop and nose plug before bending a loop at the end into which a winder may be hooked.

COVERING: Before the frames are covered carefully sand to remove all flaws and roughness. Either colored tissue or Silkspan may be used; we like Silkspan best for its handling quality. Cover the fuselage first using light dope or banana oil for adhesive. The sheet-covered nose is also covered with paper. Use individual sections of tissue for each flat section of each side of the wing, tips, tail surfaces, etc. In covering the fuselage it will be necessary to use numerous small pieces to work around the curves without wrinkles. The tissue must be lapped carefully to assure a neat job. Spray the various parts lightly with water to tighten the covering but clear dope is not applied until the model is assembled.

ASSEMBLY: Assembly of the Curtiss is simple. First fit the wing into the recess in the fuselage and cement firmly. If parts have been built with accuracy, the angle of incidence will automatically be correct. Wing fillet shape on the original model is shown; cut a paper pattern of it to fit the model exactly before cutting two from 1/32" sheet. If the builder desires, he can cut wing root pieces from 1/16" to the shape of the rear of the fillet and cement them between the fuselage and wing to support the back of the fillet. Once cemented to place the fillets are covered with colored tissue, as is the uncovered portion under the wing.

The stabilizer is attached to the top rear keel at about three degrees negative incidence. Offset the rudder about 1/16" for a right turn in the glide. Check and re-check everything for correct alignment. When dry, tissue fillets are attached between the stabilizer-rudder-fuselage. Moisten any covering wrinkles with water and dry before brushing one or two light coats of dope on the entire covering.

The model is not considered complete until numerous details are added. Rubber tubing is slipped over the landing gear wires and then doped black. Wheels are colored before being fastened by washers soldered to the axles. Cut the top of bulkhead D and cement as shown in the side view. Now cover the cockpit with thin celluloid. Make a tail wheel and insert in place. Add all the necessary insignia as seen in the photos. Control surface outlines, cowl covering and similar details are cut from tissue and doped in place.

Hook the motor to the propeller shaft and then drop the end through the fuselage. It may be necessary to remove a small section of the covering in the rear to get the strands, held by the removable bamboo pin, into position. Our model is now ready for test flights.

FLYING: The secret of obtaining fine flight from a properly designed flying scale model is simply great patience. Before actual tests are begun, the model should balance when held at about half the wing tip chord: addition of a small weight to the nose or tail makes this correction. Check the glide, warping the back of the stabilizer up or down slightly as required. Offsetting the thrust line will aid in controlling the amount of circle in either direction, and by tilting the thrust line down a tendency to stall can be eliminated. For maximum performance stretch the rubber motor and wind with a mechanical winder.

VICTORY

Accurate Props In a Jiffy

(Continued from page 35)

The blank is next cut to shape by a jig-saw or coping saw, and you have a blank as in the upper part of the photograph, ready for carving. This blank is for an engine that cranks counter-clockwise. The slots are cut at a reversed slant for a prop that rotates in the opposite direction.

The blank is carved with a jack-knife down to the bottoms of the cross-slots, with a gradual twist along the surface between the successive stations and with one surface merging smoothly into the next. Carve from the hub toward the tip, except between stations 4 and 5, where this direction is against the grain. Carve the back of the blade first and then the front. The crossection of the blank, for instance at station 2, will then appear as the sectioned area, plus the three black areas in Fig. 9. The leading edges of the back and front of each blade and the

trailing edge of the front of each blade are now carved away, as illustrated by the black areas and in the order noted (1, 2, 3) to secure the desired airfoil sectional shape. Tips are tapered off to rather sharp terminal ends. Study several props you have purchased and the diagrams in Fig. 3, to become familiar with the shape at each station. After practice carving on a few blanks, you will develop a knack for quickly carving the blank to shape.

Next, the prop is rough sanded and tested for balance on a mandrel and knife edges, and further sanded (and carved if necessary) on the heavy blade and the heavy side of the prop to secure proper balance. Finally, sand it with fine sandpaper, being sure to keep it in balance. Your prop may now be varnished or lacquered with several coats (sanding between coats) and tested again for balance. If found slightly out of balance, application of the proper amount of varnish to the lighter blade will bring it back into balance.

If you have faithfully followed the above instructions, you should be the proud owner of beautifully shaped, hand-carved propellers (such as shown in the lower part of the photograph), of high efficiency, both from the standpoint of thrust in proportion to power delivery and from the standpoint of minimum vibration of your ship due to a well balanced prop to propel it. "HAPPY REVS."

VICTORY

MacArthur Can Beat the Japs

(Continued from page 7)

nese Army is estimated at 3,500,000 men dispersed approximately as follows: 750,000 in Manchukuo, 800,000 in China, 100,000 in Indo-China, Malaya and Thailand, 75,000 in Burma and 90,000 in the Southwest Pacific Islands.

Since Pearl Harbor 104 Jap warships are claimed to have been sunk, 22 are listed as "probables," 70 have been damaged. Of these, 25 were light cruisers, more than 50 were destroyers, leaving a cruiser force of 25 and destroyer force of 85, all of which are in the Pacific, for Japan has no "two-ocean" naval problems. The Japanese Navy, under Admiral Osami Nagano, has at least as many fighting tons in the area as have the Allies. Present indications are she is undertaking a vast submarine campaign aimed at vital supply lines to Australia.

At Pearl Harbor Japan started the war with a total of between 5,000 and 6,000 combat planes (see MODEL AIRPLANE NEWS, February 1942 issue) of which approximately 2,000 have been destroyed in all theatres. They are now building about 1,000 per month and it is to be remembered there have been 18 months of war! Although still used widely in the Pacific theater, the Mitsubishi Zero (MODEL AIRPLANE NEWS, January 1943 issue) has been replaced largely by the Sento KI-001, a design quite similar in appearance but with improved performance, power, armament, and greatly increased armor. Two other types have been seen in action, both with two engines mounted tandem and driving counter-rotating propellers. The AT-27, of which one version has been examined, is a long, sleek monoplane bearing a resemblance to the Italian Macchi C.202 (MODEL AIRPLANE NEWS, February 1943 issue) and powered by two 12-cylinder "V" steam-cooled engines mounted forward and aft of the cockpit. Wing area is 237 sq. ft.; it weighs 8,000 lbs. empty and 11,600 lbs. fully loaded. It is said to have a top speed of 410 mph and range of 1,250 miles. The second plane is the Suzukaze 20 monoplane, powered with two radial, air-cooled engines mounted tandem and driving counter-revolving propellers. The Suzukaze 20

has a wing area of 144 sq. ft. and gross weight of 6,300 lbs. It is claimed to have a top speed of 478 mph, an amazing figure. Two interesting features in this machine are the vertical stabilizer which fairs upward from the cockpit enclosure back to the rudder, half the fuselage length, and the mounting of the guns one above the other in pairs in the wings. These are said to be adaptions of the British .51-caliber Bofors gun.

It is difficult to estimate the total pilot casualities of the Japanese Air Force since they are shot out of the air and no notice taken of their landing by American and United Nations pilots. After parachuting down, they may land on any of the thousands of islands or be rescued by Japanese surface vessels covering the area. A guess is that 1,800 pilots have been killed.

Japanese bases are strategically located, adequately garrisoned and strongly fortified. She has huge naval establishments at Rabaul, New Britain (Jap's largest naval base in the Southwest Pacific); Surabaya, Java; Hong Kong, China; Manila, Philippine Islands; Formosa; Truk Island, Micronesia as well as Yap; numerous giant naval bases in Japan proper and the northern naval outpost at Paramoshiri Jima, just south of Russian Kamchatka Peninsula. In addition to these naval bases she has a string of airfields extending from Manchukuo through China, down the Indo-China and Thailand peninsula and out along the Malayasian chain to Borneo, the Celebes, New Guinea, and the Solomons. And she is still building airfields despite heavy bombing by Allied bombers. On Munda, only half-an-hour's flight from Henderson Field, she has constructed an airfield under continual heavy bombardment by Fortresses and Liberators. It was recently revealed there were actually several runways at Munda rather than one, the others being graded and filled beneath giant camouflaged nets intertwined about the palm trees!

Japan has everything a nation-at-war demands to carry on a campaign for an indefinite period. She has all the oil and rubber she can use (the majority of the world's supply of rubber). She obtains iron from Korea, Indo-China, Malaya, and Philippines, enough for 8,000,000 tons of steel production annually. She obtains lead and zinc in Burma, bauxite (from which aluminum is made to build airplanes) in Malaya and the Dutch East Indies, chrome in the Philippines and antimony (primers for shells, plates for storage batteries) in China. For food she has rice from Burma, Thailand and Formosa; sugar from the Philippines and the Dutch East Indies, soybeans from China. Her fishing licenses with Russia in the Bering Sea has been renewed for another three years. Japan does, however, have a shortage of copper, lumber and precision machinery for manufacture of machined aircraft parts. She badly needs a good ball bearing, according to those examined on captured airplanes.

This, then, is the problem facing General Douglas MacArthur, supreme commander of the United Nations Forces in the South Pacific. Against this ominous force he has few men, fewer planes, an almost meaningless trickle of supplies from America. For a whole year he has been able to do nothing but hold fast, defend what is left of United Nations soil; wait, plan and pray. Only a single thread-like life-line connects Australia and the United Nations bases with the United States, a torturous 8,200 miles route through Japanese-invested waters. The route to India has long since been closed and the Japanese are making every effort to sever the eastward line through the use of airplanes, surface vessels, and now submarines! Sparsely sprinkled are United Nations bases protecting that supply line. From the West Coast or Panama ships head west with their precious cargoes of planes, cannons, food, men, and supplies of every description. Protecting them are the huge naval base at Pearl Harbor, Hawaii, now one of the most powerful bases in the entire world. From Honolulu ships head southward via United Nations bases to New Zealand and Australia.

From these latter they are carried overland to Cairns and Darwin from whence they are flown to Port Moresby and Guadalcanal, the only two United Nations bases in the entire Pacific in the actual combat zone. Frequently three months have elapsed from loading of supplies on ship and delivery of them to soldiers on the firing lines.

Will Japan invade Australia? From a strategic point of view a Japanese invasion of Australia would cost a great deal and accomplish very little. Australia's population and wealth centers around the Southeastern and Southwestern areas more than 1,500 miles from possible Jap landing places at Darwin or along the Queensland coast. Japs may try to smash Darwin because of its strategic location as a base for attack on Japanese installations in Java, Timor, and New Guinea. To attack Australia's eastern coastline would be a difficult operation and the Japs must first capture Port Moresby. From this point the Japs would have to penetrate the treacherous, saw-toothed Great Barrier Reef extending from Papua southward to Rockhampton, Australia, and the only charted entrances to the Reef have been well mined against such a step. And the Japs would be under continuous aerial assault as well as artillery fire.

Japan has little reason for invading Australia but big reason for wanting to cut the supply line to Australia and thereby effectively put her out of the war. To attack this supply line she needs bases in the Solomons, New Hebrides, and New Caledonia, all now effectively held by the United Nations. MacArthur has been able to do little but protect this supply line by holding what he has and fighting carefully and conservatively for strategic bases from whence to carry on this work.

But one word preys on his mind booming louder with each tick of the clock: OFFENSE! To smash at the Japs everywhere, 24 hours a day, until his treacherous hordes can never again threaten free men. And MacArthur has the first vague

beginnings of such an offense—for it will be an aerial offense and he has Lieut. Gen. George C. Kenney, one of the most able air officers in the armies of the world, as his Commanding General of Allied Air Forces and Commanding Officer of the United States Fifth Air Force. Flying for him is the best equipment available, and known to be in the South Pacific are Boeing Flying Fortresses, Consolidated Liberators, Lockheed Lightnings, Douglas Bostons, Martin Marauders, North American Mitchells and Curtiss Kittyhawks. Commanding the Solomons Air Forces is Major General Millard F. Harmon, also in command of the ground forces. In charge of air operations in New Guinea is Brig. Gen. Ennis C. Whitehead, Kenney's adjutant, and in China is the Fourteenth Air Force under Brig. Gen. Claire Chennault.

To drive Japs from the South Pacific is the work of airpower in all its manifestations. First of all it will require airplanes, bombers, fighters, cargo planes and reconnaissance planes. Bombers are being flown in from China, India and Honolulu. Recently it has been announced that Lockheed P-38's are now capable of 3,000 miles range, enough to permit them to be ferried in. These planes must be flown in large numbers, constantly, in a rising tide. Certainly some may be lost en route, but such sacrifices must be made. Ships cannot carry enough airpower to MacArthur soon enough. Shortly there will be in service the largest aircraft carrier fleet the world has ever seen. In addition to dozens of combat carriers there will be scores of converted merchantmen and build-from-the-keel light carriers now building in West Coast shipyards. These carriers will serve a two-fold purpose: landing and refueling stations for fighters, and protective escorts for shipping and flying lanes.

With increase in flow of aircraft, MacArthur must next obtain flying fields, literally hundreds of them in South Pacific. He now has prepared air bases south of the great Japanese barrier arc extending from Singapore to the Gilbert Islands. And he must have hundreds of these fields. They must be constructed on every island and spot of land which is reasonably level for the required length of runway.

Japanese airpower, now on the increase in the South Pacific, must be destroyed—and this is best done with fighter planes. His bases must be attacked with heavy bombardment craft and his planes must be shot out of the air by fighters. His ships must be sunk by torpedo planes and light bombers. These three functions call for three separate air forces, a Strategic Air Force made up of heavy bombers to destroy Jap naval and air bases and fortifications, a Tactical Air Force made up of fighters to cut Nippon's pursuits out of the air, and a Coastal Patrol Air Force to strike at enemy shipping on the thousands of inlets, seas, and water passages.

Rabaul can be taken by a pincers movement first by air, then by land. Bombers from Henderson Field and Port Moresby can strike around the clock smashing the ships in the harbor and destroying land

installations. Troops and equipment can be flown in first to Madang and Bouganville, then to New Britain Island itself, just as they were in the Buna and Gona campaigns. Carrier-based torpedo planes, hiding by day and striking by night, can blast the ships attempting to escape. The carrier, easily the most vulnerable of naval craft, must be expendable and their loss expected in the actions. Once taken, Rabaul can become the United Nations primary air and naval base from whence continuous day and night attacks on Japanese Naval bases at Truk and Yap can be pounded home. The fall of Rabaul will release the threat to the lifeline and permit vastly increased flow of supplies to be established. The entire eastern portion of the Southwest Pacific would thereby be cleared of the Jap menace, permitting landing of an army in Australia and establishment of a Naval Force in Melanasia: something now too dangerous to attempt.

Wake Island must and will be recaptured and it can be done by a combined sea-air assault. Land-based bombers from Midway can reduce its small garrison and fortifications, and sea power can land troops. Once again in U.S. hands, the base can serve as a pincer base for attack on Truk. And with combined aerial attack from heavy land-based bombers southward from Wake and northward from Rabaul, Truk island could not long last. The Jap base at Jaluit in the Marshall Islands can be struck by bomber from Henderson Field and from Howland and Baker Islands. Once these bases have been set up and United Nations airpower has won aerial superiority, MacArthur's fond dream of a return to the Philippines will not be visionary. Once his supply line can operate free of Japanese airpower and submarines, MacArthur can attack Timor, Java, and the Celebes.

To aid him in this great task he must have combined aerial actions from the Aleutians and from China. Once Burma is freed from Japan a flow of aircraft can be established into China, the strategic base for attacks on Singapore and Thailand and the final knock-out blow against Japan itself. Air Power is the key to MacArthur's success—fighters to break forever Japan's aerial superiority, bombers to destroy his naval and military bases, and cargo planes to land troops and supplies in vital positions.

MacArthur has been told these things must wait; he has been told the Battle of Europe must first be won before quantities of men, supplies, and planes can be delivered to him. The cry has been raised that with the collapse of Germany will come the collapse of Japan. This is **not** true, in any sense. Japan functions completely independently of Germany and Italy. She has her own resources and her own master plan of conquest dependent on no one. MacArthur is fighting a separate enemy in a separate theater and must have a separate Army, Navy and Air Force to do it. And Japan's threat to these United States is far, far greater than that of Germany or Italy! Japan *can* win in the Pacific; she *can* attack the United States, she *can* fight a war of five years, or ten years or twenty years; but

GRUMMAN F3F1

U. S. NAVY SHIPBOARD FIGHTER

32" Span. Length 24". 1" Scale

A fine detailed model with retractable landing gear, 4" turned motor front, 3 oz. grey dope, ½ oz. yellow, 2 oz. glue etc., all parts printed, 10" propeller, wheels, full size drawing, and all parts. This fighter plane is used in large numbers on the aircraft carriers. Const. Set complete, postpaid.................. **$3.75**

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32" Span. Length 25". 1" Scale. Color, Silver

Set has 4" turned motor front, 10" carved prop, wheels, tail wheel, all parts printed, 3 oz. silver dope, ½ oz. black, 2 oz. glue, etc., insignia, and full size scale drawing. New improved model has retractable landing gear and movable controls from cockpit. Set, postpaid.................. **$3.25**

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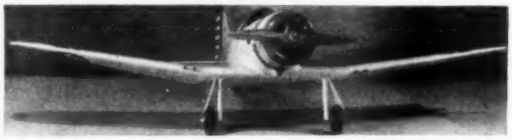
Scale Gas Model



48" Span. Length 33". Class "8". Motor Driven

A real steady flying scale model with plenty of wing dihedral for stability. Get the thrill of flying a real fighter gas model. Const. set, complete with full size plans, postpaid.................. **$7.50**

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40" Span. Length 35". ⅝" Scale. Color Silver

A beautiful model of the world's fastest bomber. Set has all parts printed, propellers, wheels, insignia, 4 oz. silver paint. 1 oz. black, motor fronts full size scale drawing, and all parts to build. Construction set, postpaid.... **$4.75**

Thousands of this type of plane are fighting for the U. S. and Britain

BOEING B-17 FLYING FORTRESS BOMBER

44" Span. Length 30". Color Silver. Weight 6 oz.

THE MOST SENSATIONAL EXCLUSIVE BOMBER SET IN THE WORLD

Set has all parts printed, four 2" special finished motor fronts, four carved props, wheels, set of paints, glue, and full size drawing.
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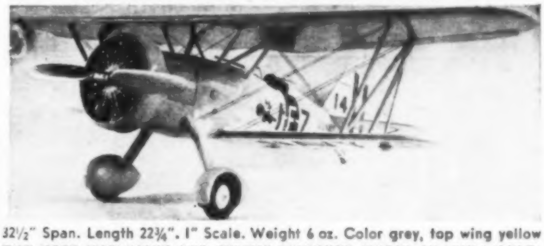
CURTISS HAWK F11C4 PURSUIT NAVY



32½" Span. Length 22¾". 1" Scale. Weight 6 oz. Color grey, top wing yellow

THE MOST EXCLUSIVE AND FINEST EQUIPPED MODEL IN THE WORLD. MOVEABLE CONTROLS WORK FROM COCKPIT. A special de luxe model, one of the most beautiful ever made. Set contains a 4½" scale Wright Cyclone celluloid motor, detailed push rods, fins, etc., like real motor, 4½" aluminum cowl, 10" steel type carved prop shown, 2⅛" wheels, tail wheel, star and rudder insignia and lettering, windshield, instrument board, flying wires, 4 aluminum step plates, aluminum wing walks, ready cut wheel pants, washers, 3 oz. grey paint, ½ oz. yellow, ½ oz. red, 2 oz. glue, etc. All other parts are printed 33"x41" scale drawing. Const. set, complete in labeled box, postpaid......... **$4.50**

TWO NEW READY BUILT SOLID MODELS

NEW CURTISS P40F WARHAWK SOLID

14" Span. Length 11¾". ⅜" Scale

Ready built masterpiece solid model, beautifully finished. Cast prop.
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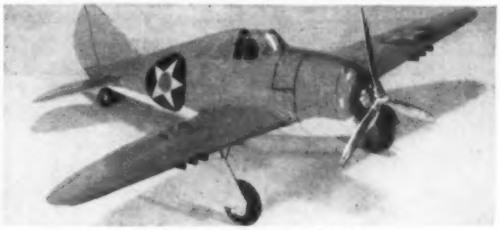
REPUBLIC P43 LANCER SOLID



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22½" Span. Length 14½". ¾" Scale

Set has 3" celluloid motor, 3¼" tapered aluminum cowl ring, set of paints, all parts printed on balsa, drawing, etc.
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BELL P39 AIRACOBRA U. S. ARMY FIGHTER

34" Span. Length 29". 1" Scale

New fighter to scale, parts printed, paints, glue, etc., wheels and all parts.
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MINIATURE AIRCRAFT CORP.

83 DANIEL LOW TERRACE
STATEN ISLAND, N. Y.

she must be stopped now and airpower can do it. With sufficient airplanes, with General Kenney, with able fighting pilots, bombardiers, navigator and gunners, with skilled ground mechanics and technicians and with a mighty will-to-win, MacArthur can clear the Pacific of the Japanese menace which has threatened western civilization for 2,500 years! But he must have these things now! And he can get them only through the full-hearted, hard-working efforts of every American man, woman, and child. Those who cannot fight must build the weapons of war. Those who cannot build must lend their money. Japan's war is our war, each of us. Do your share!

VICTORY

Air Ways

(Continued from page 27)

dope or camouflage paints. He has been doing this work for ten years, and in addition takes and processes his own photographs.

Charles J. Hein is Publicity Director of the Sky Wolves of Des Plaines, Ill. They are rabid U-Control fans and have set up a regular calendar of forthcoming contests. The first one is June 13th—Sky Wolves Championship Meet; the second, July 14th; the third, Aug. 8th—Des Plaines Valley Championship Meet; the fourth, Sept. 5th.

Another name for our Honor Roll of modelers in service is Pfc. Frank Norman, AAF, who was recently home on furlough. Mr. Hein sends us pictures 2 and 3 on page 26, which he says shows what happens to a perfectly good model design when the builder runs out of balsa wood. Evidently this little ship started out to be a fuselage model but grew two tail booms and a small nacelle instead. In spite of this it is a good looking job—in fact, very unique in many ways—one being the motor mount. This forms the front and under-half of the nacelle, in which the entire motor unit is located. Picture 3 shows the unit detached from the ship. It may be assembled or taken off in a few seconds.

The U-Control wires and mechanism is located in the upper half of the nacelle; with this arrangement there is no interference between control wires and power unit. Because of this the latter can be quickly detached from the plane, which has a wingspread of 28" and is 25" long. Power is supplied by a Foster 29, the whole ship weighing 27 oz. Mr. Hein says this design is exceedingly maneuverable and very fast.

All model builders will recognize with considerable reverence the name of Peter W. Westburg, of West Los Angeles, Cal.; he is one of our oldest model builders, not in age but in experience. He is not satisfied with building distorted looking planes of which most contest models are typical. His designs embody good looks and appearance similar to large ships, as well as excellent flying qualities. Picture 4 on page 26 will illustrate what we mean. Here is one of his latest gas jobs and it certainly has "umph." You will note how the full wings are carefully and beautifully fared into the fuselage, which resembles that of some of our latest observation planes. The motor is inverted and the landing gear has been improved in appearance as well as strength by employing fairly large-diameter fairing for the struts. Westburg says the model is an excellent flier and has a most realistic appearance when in the air. Unlike his former models, this ship is U-Control. A unique feature is the power-plant assembly which is removable even with the cowling and propeller in place. Westburg says, "This has saved me much time and trouble in trouble-shooting the engine." The span of the model is 46"; length, 35-1/4".

Fred C. Cooper of Cortland, N. Y. sends us the picture at bottom of page 26. It looks very much like a full size ship but actually it is a gas-powered model of the Republic Thunderbolt P-47, constructed by Carlton W. Cooper and his father, Fred C. Cooper, to a scale of 1" to the foot. Fuselage is of 3/32" x 1/4" strip balsa; wings and stabilizer of 1/16" sheet and rudder of 1/4" sheet. The whole is finished with three coats of filler and twelve coats of aluminum dope rubbed down after each coat. Two coats of aluminum dope glamorize the interior. It is built to fly with control line and has landing flaps which are lowered by the same line which cuts the ignition, no timer being used. A Baby Cyclone Model B motor supplies power, driving a four-bladed gun-metal-finish propeller. The plane's interior boasts an aluminum seat with safety belt and buckle, a facsimile of a complete instrument panel, radio receiver and transmitter, miniature head phones with sponge rubber ear pads, microphone, oxygen tank complete with valve, gauge and tubing connected to oxygen mask, a fire extinguisher 1-1/2" x 3/16" in diameter which will shoot a tiny stream of water 15 or 20 ft.; a quadrant on the left side of the cockpit contains the throttle and other control levers.

In spite of all this weight complete is only 2-3/4 lb. It required about 350 hours of intensive work to complete. Cooper now is most anxious to test fly it despite the danger of cracking up so much careful workmanship. Up to the present time weather has not permitted it.

Sidney Fox of Quincy, Mass., seems to have the idea of what we need for "Airways," which has resulted in picture 6 on top of page 27:

1. An excellent clear photograph of his model—yes, this is a model not a full scale ship. 2. He has posed it in most lifelike position. 3. The model itself is an excellent piece of work. These model builders are great little deceivers, for the background of the model water and spray is not what it seems to be. The water was made by lay-

ing down a coat of wrinkled up tinfoil, spread flat. The spray is far from being wet because it is only cotton. Proper material is not the only thing needed, for a little artistic touch is required to give the realistic appearance. Fox not only photographed his model but also processed the pictures. Incidentally, he knows how to obtain the proper lighting effect to show off the lights, shadows and contours of the ship. We hope to hear from Fox again, especially as he tells us at the time this is read he will be somewhere in the army—so, his name is placed on our Honor Roll.

Frank S. Gue of Edmonton, Alta., Canada writes as follows:

"Model magazines and the building public in general have lately been heard to sigh ominously and shake their heads over the future of flying-scale building with pine. 'It's very well,' they say, 'to build an endurance ship, with four longerons and straight spacers, with pine, and not feel the difference much. But wait until you get a ship with two dozen sheet formers and a score-odd stringers . . . '

"Well, I'm one of those persons to whom a suggestion like that is an encouragement rather than otherwise. The result is the ship you see in pictures 7 and 8, page 27, 2nd and 3rd from top.

"The plane I selected was Earl Stahl's lovely little Curtiss S03C-1, from Dec. 1941 M.A.N. . . . a honey of a scale if there ever was one. This model I built entirely from pine . . . with the sole exception of the landing gear fairings, which might just as easily have been made with laminations of bamboo tissue and Weldwood. The formers were 1/32" sheet, but the stringers were standard 1/16" square, as called for on the plans. Only concession to the use of pine was the lightening of the 1/32" sheet ribs by conventional cutouts, and the omission of Mr. Stahl's favorite little trick of sheet-covering the front top section or so of the fuselage. L.e. and t.e. were not reduced in size from balsa specifications, nor were sizes of wingtip and empennage former sheets. Conventional light grade cement was used, and seemed to grab the pine just as lovingly as it ever did balsa, if not more so. Material was the best I could get hold of . . . Jasco-Pine, which is beautiful material. The sheets, however, aren't pine. I'm no expert on woods other than balsa, but I think the 1/32" sheet I got was maple, which turned out to be the smoothest-cutting, least splitty, and toughest stuff I have ever used. Intricate formers come out of this thin maple with unbelievable ease. Construction is a joy, due to the strength of the formers and resulting ease of stringer installation.

"The result of all this is a ship which undeniably weighs more than its balsa counterpart; but consider the strength and durability of the structure! An identical ship of balsa might weigh less, but would be pretty fragile. The completed ship, covered, ready to fly with two coats of thin colored dope, weighs 2.92 oz., for a wing area of almost exactly 116 sq. in. . . . which is, I think you'll agree, far from excessive. It is interesting to note that a full-sized pine propeller, of 8" diameter, of the design Mr. Stahl uses on his original, was carved, doped and equipped with free-wheeler for a weight of only .3 oz. It's thin, but being of pine, is as rugged as necessary. Such niceties of structure add to the enjoyment one gets from building under wartime difficulties. Pine tail surfaces for this ship weighed bare 2 oz.

"You may add my voice to the growing number who have declared their intention of sticking with pine for most work, regardless of what happens to balsa. Scales included, I'll be using hardwoods henceforward in most of my work." (*Editor: Why not basswood—it is stronger and does not shatter.*)

John Tatone of the "Frisco Vultures" writes and sends picture 27—fourth from top on page 31. Though the picture is not very clear the ship nevertheless is outstanding, having unofficially broken the A.M.A. Sr. R.O.W. record. On Sept. 13th, 1942 the first flight was 5 min. 39 sec.; the second, 2 min. 15 sec.; the third, 2 min. 35 sec., giving a three-flight average of 3 min. 27 sec. The flights were made in the second of a series of R.O.W. contests sponsored by the San Francisco News Exchange Club. You will note the ship is unusual in the type of floats employed, two are at the front and one at the tail. Usually gas models use only two long floats without a tail float. Wingspan is 6' 5" with a 12" chord. The airfoil is a Grant X9 which gives the ship a high rate of climb and rides as well on the slightest breath of a thermal. Power is supplied by an Ohlsson 60. Test flights were made with wheels instead of floats, flying well from the start. The third flight was for 15 min.; the fifth for 11 min. Floats were made one week before the contest, the main floats being placed well ahead of the c.g. with an angle

Pict. 11. 1st Lt. J. R. Harris of South Bend, Ind. (left) and 2nd Lt. Tom R. Chalcraft of Boston, Mass. (center) assist Edward Bostock, a district warden, in judging a model contest in England.

of attack of 3-1/2°.

On the first flight the model took off in the same position as at rest on the water and did not plane. The climb was a "corkscrew" to the left straight up. No change in flight was noted when changing from wheels to floats.

Donald Paige of Peru, Vt. has been experimenting with a new type of skis since sending the picture of his high aspect ratio model last month. Donald has the advantage over most of us—he can continue his ski plane experiments well into the Spring and in fact some years into the first part of Summer. You see, he lives high up in the Green Mountains of Vt. where wintry winds blow until June; when he sent picture 10 shown at the bottom of page 27, there was more than 14 in. of snow on the ground. Here you see his high aspect ratio stick model equipped with a tricycle ski gear—something new for modelers. He says this was an experiment and finds that the three skis are too heavy for this particular model, but with three wheels the ship flies well. He intends to refine and lighten the gears still more, so he has hope of some better performance.

"That freckle-faced, tously-haired kid next door to you—the kid who dreams some day of flying his own ship but is now building model airplanes down in his cellar"—is contributing his share toward winning this man's war. This is true in England as well as America.

Those are not toys, but weapons of war. The model planes that he has painstakingly and patiently put together to exact scale are being used in England's VIII Air Force Service Command to teach soldiers how to identify planes, both friendly and enemy. That is important here and in England; a soldier's ability to identify an airplane quickly may mean the matter of life or death.

"Those kids really deserve a bit of praise," said 1st Lt. Lon A. Wyatt of Jackson, Miss., who is in charge of all aircraft recognition activities in the VIII Air Force Service Command.

"Every day we are sending more and more model planes out to our various units," Lt. Wyatt continued. "While many of these models are made by British commercial manufacturers, there are also many from American students."

For proof Lt. Wyatt produced some model planes built by those "freckle-faced kids." On the under side of the wings there were identification tags, showing where the models were made. There were many planes from Edgewater Public Schools, Edgewater, N.J.

There also were many models from Easton High School, Easton, Pa. One was a Junkers 88, built by Kenneth Stocker of Easton High. Another was made by Harry Hockenbury of the same school.

On another model—this one a Bristol Blenheim—were the words "Tucker, Orange, N.J."

"This is one of the best I have seen," said Lt. Wyatt.

This particular model also drew the praise of 2nd Lt. Tom R. Chalcraft, Jr., of Boston, a member of the Academy of Model Aeronautics who directed the Junior Aviation League in Boston before his entry into the U.S. Army Air Force.

Lt. Chalcraft, who works with model planes in his assignment in England, has run across models built by former pupils of his in Boston.

"In working over here," he said, "I have seen models built by Gunnar Munnich, Jr., Edward Walsh and a boy named Doyle, so far. They are from Boston. I also have seen models from other cities, such as Cleveland, New York, Chicago, Columbus, Memphis and others.

"In peace time when I used to instruct junior aviators and checked on their work, little did I realize that these models would come once again into my hands. I am beginning to realize fully how worth while those long hours of study with these young fellows has turned out to be. The young builders have turned their pleasure job into a real hard war task."

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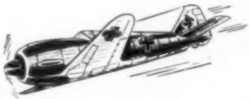

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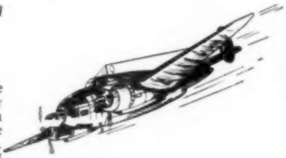

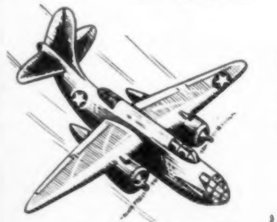

DOUGLAS "BOSTON" A-20
Model S-14. Span 15¼"
The "Boston" has been in the war since the start. It is used for long range flying and bombing.
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ITALIAN "MACCHI"
Model S-11. Span 13½"
Italy's best fighter plane of World War II. The ship that our Air Corps in Africa had to recognize and dog fight. Model has complete details with markings and insignia.
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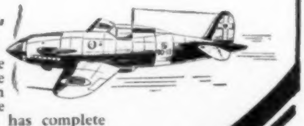

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tion, models are used extensively. One of the favorite methods is to blindfold a soldier, hand him a 1/72″ scale model and have him identify it by feel and touch. Another is to suspend models from the ceiling in a dark room and put a flashlight on them one at a time, with the student identifying each.

Picture 11 shows 1st Lt. J. H. Harris of South Bend, Ind. left, and 2nd Lt. Tom R. Chalcraft of Boston, Mass., center, assisting Edward Bostock, a district warden in England, in judging models built by English children. It seems that our model boys get around and in officers' uniforms too.

Charles Stewart of Plymouth, Mich. writes and says that on the 21st of March, the Junior Chamber of Commerce sponsored Michigan's first indoor U-Control contest at the Yost Field House in Ann Arbor. Because the meet was indoors the fliers had to cut down their guide lines to a length of 45 ft.; the boys who flew the 50 ft. lines usually smashed their planes into the balconies. One club came all the way from Cleveland and took first place in Classes A and B. There were a few scale models and only one was flown: a Vultee that was a beautiful looking and flying job. About 400 spectators attended the contest.

Stewart says he was lucky enough to get in an official flight with his Fireball powered with a Bunch motor. The high speed for Class C was 82-1/2 mph, accomplished with a plane of 24″ wingspan, powered with a Hornet motor. The flier who owned this plane walked away with most of the prizes including an Ohlsson 23, an Ohlsson 60, a model kit, a gallon of dope, and an Xacto knife set (we wonder if he is going to set up his own store). In Class B the fastest time was 56 mph.

Corp. Cleon Long, A.A.F.T.S., and Pvt. Pat Packard, A.A.F.T.S., who are stationed at Headquarters Technical School, AAF Technical Training Command, Photograph Section, Sheppard Field, Texas, write as follows:

"Have been following Model Airplane News for quite a few years and have finally decided to send in a picture of what we are doing down here in Texas. We work in the engineering department at Sheppard Field and are building model airplanes in the spare time that we have. Also are working on some new ideas in the line of plastic models, which are in the stages of construction. Will forward you some pictures as soon as the completed model is finished.

"We are both building a sailplane and have it nearly completed. The kit itself was won in a contest better than two years ago and all the wood and materials are still in good shape. Have a Demymite for power which should really send it places. There is very little model activity around this part of Texas but we happened to run into each other in the dept. here. One of us is from Oregon and the other from Wisconsin. Are gradually getting all our model equipment sent down here.

"We have our own workshop in town, using half of a double garage. Did a little experimenting with plastic construction and molding which, am sorry to say, did not turn out so well. Some of the "plastic" is still trying to harden and the experiments were attempted last winter. The idea we had is pretty good. All we need is a plastic we can use easily. Got any ideas?"

We just had word from Leon Shulman who says "I made it and am now an aircraft cadet at Maxwell Field, Ala., taking the pilots' pre-flight course." He says he is going along fine because of his model experience. After seven more weeks he will be sent to Primary Flying School and will learn to coordinate the feel of real airplanes with the sensation acquired in his dreams while piloting models.

The following interesting news appeared recently in the "World-Telegram":

"A few years ago, before the world caught fire, there were a hundred kids like Leon Friedman at Van Cortlandt Park each Sunday.

"Model planes under their arms, they'd wade through the hikers at the subway stairs, march over to the park and make believe they were a Wright brother or a Corrigan. You don't see many of them now. Perhaps they're all in Tunisia—like Leon Friedman.

"Leon, thin and dark, is the 22-year-old son of Mr. and Mrs. William Friedman of 2186 Walton Ave., N.Y.C. He's a first lieutenant now and he's in with one of the fastest, most-high-powered outfits in the service—the combat air force in Tunisia.

"An Associated Press dispatch from Tunisia today told some of the exploits of those babies. One of their planes coasted in the other day with part of its underside scraped off by a phone pole. Another trailed 40 ft. of copper wire. A third was shot up so badly that it landed at 250 mph, which just can't be done—and the pilot walked away from her, unharmed.

"Lt. Friedman, the boy who flew gasoline models in the Bronx, is one of the gang there—and doing nicely."

Edwin C. Taylor of Richmond, Va. suggests that we have an interesting story of some club each month and he starts the ball rolling by submitting one:

"Well, here's the story and finis of 'The Richmond Aero Screws.' I noticed in the latest issue of my M.A.N. that you would like the names of modelers now serving the Stars and Stripes. I guess our story is the same as hundreds of other clubs all over America.

"Well, we started out as a bunch with the same interest—models, and slowly got to know each other through hot summer days

spent at the field (where a successful first flight marked you as an expert). That was back in the good old days, and long winter nights mauling over that ship that *had* to win in the coming seasons.

"Then came the summers of piling into the 'ole bus' after a sleepless night to put off to some contest where there was 'hardware' to be brought back. There was also a 'Beat Dick Everett' movement, as he had a bad habit of carrying home most of our hard-worked-for prizes, when we threw a meet in Richmond.

"Then came the war; first our president, Buddy Noel, left to become an officer in the U. S. Army; then Frank Catoni, a glider pilot now somewhere in Texas; Eddie Miltz, a U-Control champ and no slouch at free flight, an Aviation Cadet in Texas; Kendall Loving, with the infantry in Ga.; Austin Leftwich, Sig. Corps; Billy Wills, Navy; Clarence Wasser, AC in Ohio; John Martin, officer in Air Corps; Dave Catoni, Air Corps in Florida; Charles Parrish, drafting in an essential industry and myself awaiting call as an Aviation Cadet in the Naval Air Corps."

How about a story each month from clubs to put in "Airways"?

VICTORY

Winged Lightning

(Continued from page 23)

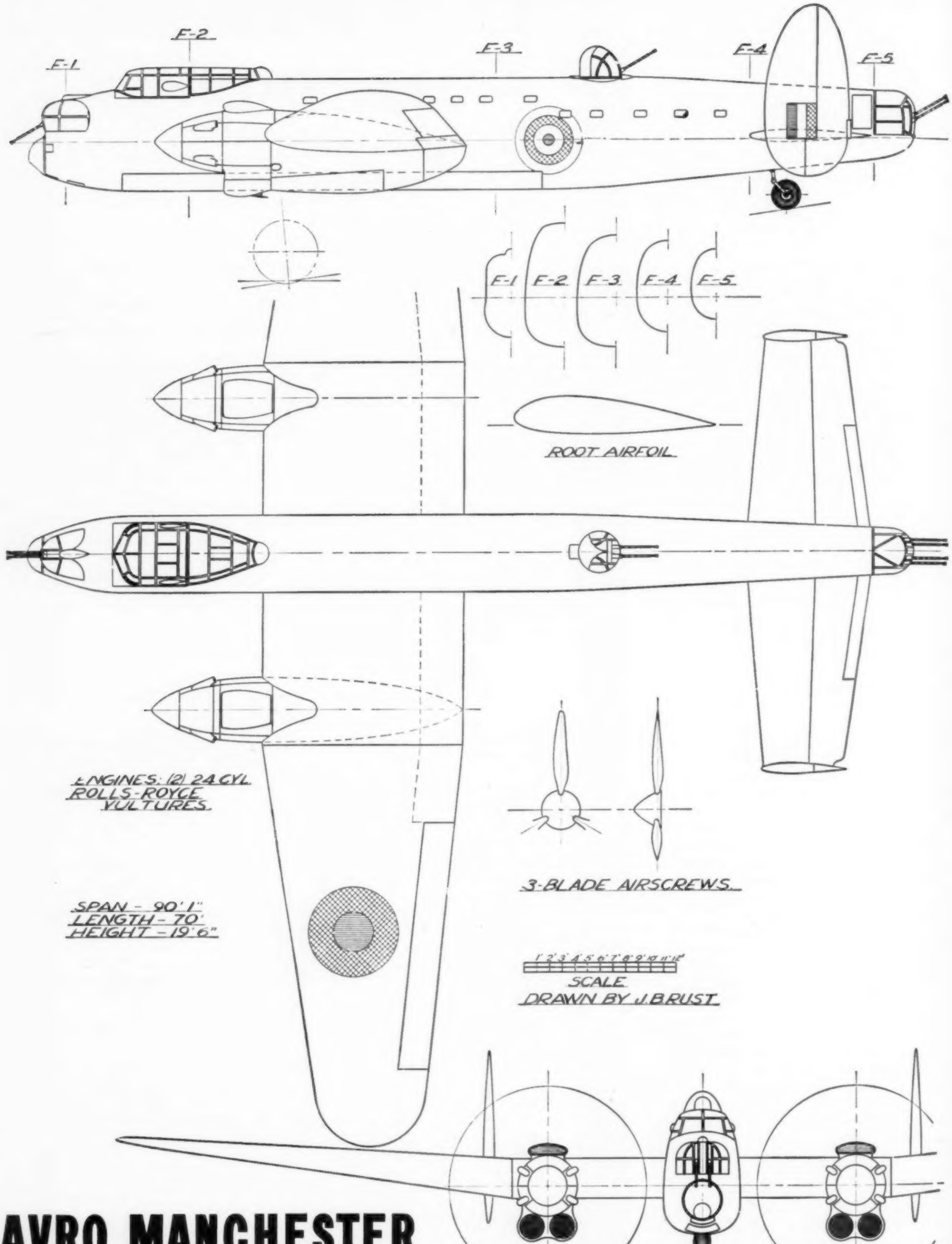
ble trimming tabs controlled from the cockpit by the pilot while in flight.

The fuselage projects forward of the wing trailing edge; is of semi-monocoque structure built up on the two nose gear keels which support the transverse frames. These are covered with Alclad flush-riveted plating supported by longitudinal stringers. The fuselage supports the armament, nose gear, pilot, flying equipment and radio equipment.

The landing gear is of the tricycle type, nose and main gears folding rearward and up into the structure being completely covered by "clam-shell" doors sealing the openings. Retraction is by hydraulic pressure from the main hydraulic system as is the main gear and nose gear doors. Hydraulically operated up and down locks secure the gears in position.

The Lockheed P-38 is powered by two Allison liquid-cooled engines mounted on truss-forging engine mounts suspended from the main wing spar. The Allison is a 60° "V" 12-cylinder type with a total displacement of 1710 cubic inches. The cylinders have a bore of 5-1/2 in. and the pistons a stroke of 6 in. The compression ratio is 6.65-to-1 and the blower ratio of the gear-driven main stage is 7.48 to 1. Cylinders are made of aluminum with a cast iron inter-liner and there are two intake and two exhaust valves of the overhead type in each cylinder. The engine is rated at 1100 hp. @ 2600 r.p.m. normal maximum. It develops 750 hp. at cruising speed of 2280 r.p.m. and has a maximum takeoff power of 1325 hp. at 3000 r.p.m. on 100 octane fuel. It weighs only 1345 pounds or only 1.15 pounds/brake horsepower, the lowest ratio yet achieved by a standard production liquid-cooled type.

In the P-38 installation the right-hand engine rotates in a clockwise direction



AVRO MANCHESTER

One of Britain's large two engine bombers that has helped to bomb Germany into ruins but which now is replaced by larger four engine planes

and the left-hand one in the opposite direction, thereby eliminating torque and improving the plane's general maneuverability characteristics.

Each engine is supplied with carburetor air by a General Electric turbo-supercharger mounted atop the tail boom midway aft of the wing spar. The exhaust manifold from one side of the engine is routed to the other side where it joins with the other exhaust manifold. From this point it runs directly aft to the supercharger drive-wheel. These hot exhaust gases under pressure are directed against a turbine wheel which revolves under the force of the blast combined with the expansion of exhaust gases. This turbine wheel rotates a shaft on which is mounted a second turbine wheel on the same lateral axis. This second wheel sucks air into the blades, compresses it and routes it forward. One of the most interesting features of the P-38 is the use of outer wing panel leading edge as an intercooler, which is used to cool the incoming air down after it has been heating by the compression of the turbo and before it is sent into the engine carburetor. The air from the compressor stage of the turbo is routed out along the leading edge wing ducts and back again into the carburetor, thereby effectively lowering its temperature but still retaining the greater portion of its pressure.

The supercharger is controlled by opening or closing the "waste-gate" which permits the exhaust to spill out into the slipstream in the quantity not required for the supercharger. This gate is normally controlled by a supercharger regulator which is connected to the throttle. In the P-38 the supercharger is automatically engaged when the throttle passes a certain point, thereby requiring no separate control. Since turbos operate at speeds proportional to the quantity and pressure of exhaust gases rotating them and, consequently, forcing a quantity of flow of air into the intake manifold of the engine, the only governing factor known to the pilot is his manifold pressure gauge. For this reason he must keep a constant watch on his manifold pressure to avoid overrunning the turbo with the consequent danger of its disintegration. There is a large steel plate mounted on the inboard side of the turbo on the P-38 to protect the pilot in the event the turbo explodes, which is unlikely but entirely possible when it is borne in mind the turbo frequently rotates at speed as high as 30-40,000 r.p.m.

The fuel system consists of four tanks located in the wing center section, two tanks serving each engine in an independent supply. The tanks are self-sealing composite construction made up of layers of neoprene, fiber and latex raw rubber. The total quantity is 300 gallons. Lockheed has developed a streamlined dropable auxiliary tank which may be fitted to special mounts beneath each center section area between the fuselage and engine nacelles. These tanks carry 100 gallons each and are claimed to decrease the P-38's top speed only 4%. The same mounts may be used for carrying bombs when not used for auxiliary tank supports. It has recently been revealed that Lock-

heed P-38's are being sent to England and North Africa through the use of these auxiliary tanks.

The oil system consists of separate tanks for each engine located in the engine nacelle. Each system includes two oil coolers mounted in pairs beneath the engines with openings in the engine nacelle nose fairings to permit entry of cooling air. Shutters are located beneath each engine nacelle to control the flow of air through the coolers and, thereby, the oil temperature.

The engine coolant system consists of a header tank (or reservoir) in each engine nacelle, two radiators and two pumps. The coolant fluid, ethylene glycol ("Prestone"), has a high boiling point which permits it to dissipate engine heat at temperatures in excess of the 212° F. boiling point of water. The fluid is pumped around the engine cylinders within the cooling jacket in which it absorbs heat. It is then pumped aft to the large radiators located on both sides of each tail boom midway between the wing and tail surfaces. The air flowing through the radiator absorbs the heat from the fluid and the cooled fluid is returned to the engine to pick up more heat. Shutters on the radiators are hydraulically controlled, operated by the pilot who, therefore, can control engine cylinder head temperatures to the normal operating range.

Propellers are all-metal Curtiss Electric quick-feathering types controlled by an electric motor mounted in the nose within the spinner units. They are constant speed variety which automatically change their pitch at the slightest increase or decrease of the load placed on them in such a manner that the engine turns at a fixed rate of speed irrespective of climbing, diving, etc. In the event one engine stops the pilot may feather the propeller (turn it parallel to the airstream) thereby decreasing drag and preventing its "windmilling."

Principal secret of the P-38's success in the battle zones is its heavy armament, on a par with the best of other fighters and superior to that carried by any known enemy single-seat fighter. A variety of armament can be accommodated and has been successfully used. The first combination fitted to the P-38 was: two .30-caliber machine-guns, two .50-caliber machine-guns, one 37 millimeter shell-gun. A great deal of controversy has sprung up over the 37 mm cannon due to its slow rate-of-fire, low muzzle velocity and great weight of shell that must be carried to make it effective. When the British Royal Air Force ordered the P-38 (which they instantly dubbed the Lightning) they specified the lighter, faster firing, longer range 20 millimeter cannon, which has proved an outstanding success. This gun, originally developed by the French Hispano-Suiza firm by M. Birkight, was developed by the British and the United States Army to its present high state. The original Chattelerault power feed has been retained. One of the outstanding successes of this war has been the American .50-caliber machine-gun, of which no other nation has an equivalent. This powerful, fast-firing, hard hitting weapon, has placed American battle planes head-and-shoulders above the opposition, and the two .30's of the P-38 were quickly changed to .50's. The most widely used armament combination, then, used on the P-38, is a single 20 millimeter cannon and four .50-caliber machine guns. These guns are all mounted in the extreme nose of the fuselage, staggered slightly to permit installation of feed chutes, ejection chutes and ammunition boxes. The nose of the airplane mounts two very large doors which are opened to give complete access to the armament compartment to permit loading and feeding the guns and ammunition boxes. All firing is by electric solenoid controlled by buttons on the pilot's control wheel.

The pilot's compartment is equipped with complete complements of flight controls, engine instruments, navigation instruments, oxygen equipment, radio receiving and transmitting equipment, airplane operational controls and armament controls. Radio equipment is mounted on a shelf aft of the pilot's seat where it is within reach for the purpose of changing frequency coils in the transmitter. The radio equipment has been removed from certain models and space provided for a second crew member, usually an instructor, to permit dual training of new pilots unfamiliar with the type.

The Lockheed P-38 has a wingspan of 52 ft., is 37 ft. 10 in. long. It stands 9 ft. 10 in. high and the landing gear has a tread of 16 ft. 6 in. Wing area is 327.5 sq. ft. and weighs approximately 14,250 lbs. fully loaded. This gives it a wing loading of 43.6 lb./sq. ft. and a power loading of 5.37 lb./brake horsepower.

Naturally, performance figures on the U.S. Army Air Forces' version of the P-38 are a military secret but British sources quote the Lightning as having a top speed of 404 mph at 16,000 ft. At this

altitude the turbo-supercharger hasn't even reached its maximum output and we can safely assume that Uncle Sam's P-38 goes a great deal faster than that, at 25 or 30,000 feet, up where the Lightning likes to operate. The enemy has a rough idea of how fast this amazing interceptor is and an exact idea of just how deadly it is! And he's the guy we're trying to convince. P-38's are proving themselves holy terrors up in the stratosphere and that's where we're going to win this war if Uncle Sam's fighting pilots have their way!

VICTORY

Airplane Design Forum

(Continued from page 21)

this factor alone gives the pilot greater confidence and saves both pilots and airplanes.

The idea of the prone position of the pilot allows steep dives and quick pullouts to be executed without the pilot passing into unconsciousness. Contrary to average opinion, the prone position doesn't decrease the resistance by reducing the size of the fuselage to any extent, because the maximum fuselage crossection is determined by the engine used if the engine is placed in the fuselage, and present day engines require a fuselage crossection large enough to readily include a pilot in normal sitting position.

In certain respects the outstanding feature of this design is the idea of including the engine in the fuselage with the two propellers mounted on the wings. This overcomes one great handicap of the two-engine fighter; namely, lack of maneuverability caused by the engine weight being placed outward on the wing a considerable distance from the airplane's longitudinal axis. This may not seem an important consideration but you must remember that in a roll any weight that is remote from the axis of the roll makes it difficult to maneuver quickly and to recover from such a maneuver. For quick maneuverability all weights should be placed close to the center of gravity. In this two-propeller fighter the engine weight is at the c.g.

Both propellers are driven through a transmission from the one engine. This type of ship doesn't assure the safe return of the pilot if one engine is knocked out; however, it is more advantageous than one propeller driven directly from one engine. Sometimes the propellers are damaged, one blade being bent or shot off. With one propeller and engine this would be fatal; however, in this case to put the airplane completely out of action the engine driving the two propellers would have to be damaged. If one propeller was damaged, the flight still could be carried on, provided a means of disconnecting the damaged propeller was included, such as a clutch.

There has been one reason why planes of this type have not already appeared on the fighting fronts. Though it is advantageous to have two propellers, it is not advantageous when transmissions are required. In this plane it is necessary to transit the power from the fuselage to each of the two propellers, requiring a chain-drive or shaft-drive with bevelled gears; possibly a hydraulic drive could be used. The latter is a system in which power is transmitted through oil pressure.

This system has not only the disadvantage of complication but usually considerable power is lost so the power delivered by the propeller is less than the delivered engine power. About 15 per cent would be lost by chain-drive; in other words, a 1,000 hp. engine would deliver only 850 hp. at the propeller. A shaft-drive with bevelled gears would be even less efficient, power loss being as high as 25 per cent. Designers have felt that the loss they have in power has not been worth the other advantages gained. If some means can be devised whereby approximately full power can be delivered under the system outlined here, then you will see ships of this type fill the sky.

We would say that one other disadvantageous feature in the design is the small wingspan—24 ft. This fighter could not weigh less than 7,500 lb. with full armament. For maneuverability and high ceiling planes should not be loaded over 33 lb. per sq. ft. This demands a wing area of approximately 230 sq. ft., whereas the fighter shown by Mr. Whiting has a maximum of 96 ft. with an aspect ratio of 6. Under these conditions the wing would have to be loaded to about 76 lb. sq. ft., which, with present lift coefficients, is out of the question because the landing speed would have to be in the neighborhood of 160 mph. as a minimum.

Also with such a high wing loading it would be impossible to maneuver the ship quickly. Therefore, the advantage of placing the engine at the center would be neutralized by this objectionable quality. If the wing had a span of approximately 38 ft. instead of 24 ft., the design would be more reasonable.

In other respects the ship is excellent. We might sum it up in this manner: from visual appearance; that is, contours and general aspects of the ship, design is excellent but not possible because of the unseen factors of wing loading which apparently have been overlooked.

To show that errors are not confined to amateur designers, we present design No. 2, the Airspeed Fighter of 1937. This ship is a combination of some excellent

(Turn to page 57)

DORNIER DO. 17 (Bomber)

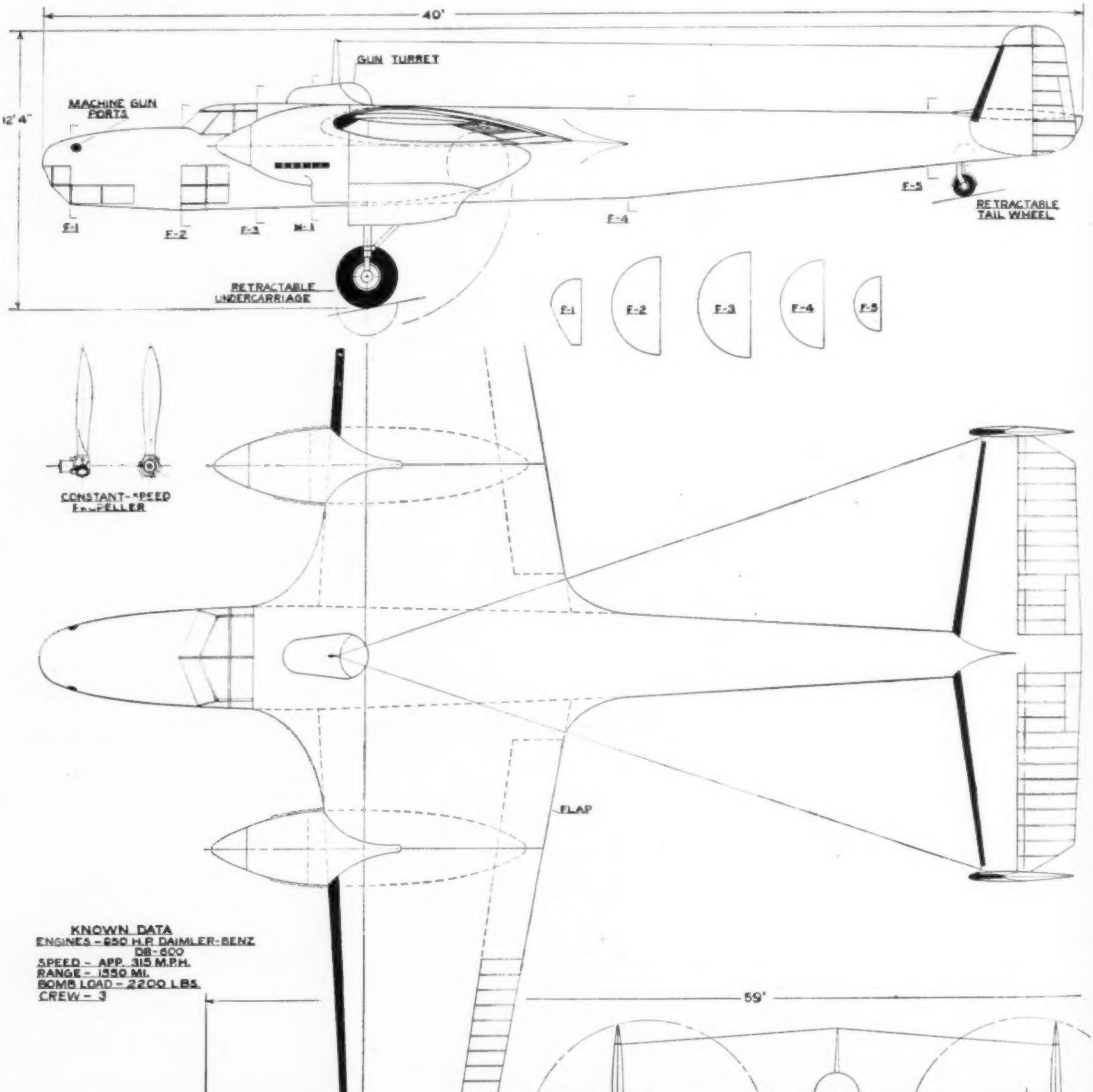
THIS is one of Germany's standard two-engine three-place bombers of the older type, having a span of 59 ft. It is powered with two engines of 950 hp. each driving three bladed controllable pitch propellers. Fuselage is all metal monocoque construction. Wings are also all metal and of cantilever construction with stressed skin. The whole structure is flush riveted.

Maximum speed is 315 mph at 13,120 ft.; landing speed is 68 mph. It has a cruising range of 1552 miles which means it can attack an objective within a radius of 775 miles.

Its armament consists of two fixed machine guns in the fuselage with movable guns in lower and rear positions.

This plane is sometimes used for strafing and bombing ground forces and shipping. It has been used extensively on various fronts.

VICTORY



ideas with others which neutralize advantages gained. Looking at the forward part of the ship we see in effect a flying wing with the engine and pilot compartment molded gracefully into the wing to reduce head resistance. This is excellent and this individual idea can be carried out 100 per cent. However, observe the stabilizer on gunner's compartment mounted thereon; it makes the whole design incongruous.

First of all, this tail compartment has a comparatively large crossection, causing considerable drag, and gives the impression that it is rather silly to streamline the forward part of the ship to such a high degree and then add resistance in another part in this manner.

Less drag, or at least no more drag, would be caused by a machine with a single center fuselage with the gunner enclosed in the tail in prone position.

This is only one defect. The most outstanding one is the placing of so much weight at the tail of the airplane. Here we have the gunner's compartment which in itself is quite heavy with the pilot and gun. Obviously with this weight on the tail, the center of gravity of the airplane would be very much further back than the center of the wing and the whole ship, according to the plan, would be completely out of longitudinal balance.

The obvious cure for this would be to shorten the tail or place the wing farther back, which in effect is the same as placing the motor more forward. This would shorten the tail booms, bringing the tail gunner's compartment closer to the wing and thereby making it still more advantageous to include the tail gunner in a single center fuselage. This change would reduce the length of the tail part of the fuselage.

From a stress standpoint this design is again an error. To carry the weight of this nacelle with equipment and pilot on the middle of the stabilizer would require an extremely strong and heavy stabilizer. This makes the tail still heavier and puts the plane out of balance still more. Keeping in mind that this is a fighter, what of the maneuverability of such a ship with the weights placed far from the c.g.? In fact, they are as far as any designer could possibly place them. It would only be possible to maneuver this ship very slowly in a longitudinal direction. In fact any maneuver executed in such a plane would be extremely dangerous because when once the plane was nosed upward or downward, it would be most difficult to recover from the maneuver because of the inertias due to weights in remote positions.

These designs are very often the result of the designer ignoring the qualities required for a pursuit plane. If he will first list these qualities and then create a design that fulfills each one he is bound to have excellent results. A few of the basic ones are: High speed, maneuverability, steep climb, and high ceiling. This means great power, large wing area, light weight, low drag, and weights concentrated.

Of course the ideal situation for each individual item can never be attained when all are put together; to attain one to the highest degree often sacrifices in others are necessary. Usually it becomes a problem of the designer to compromise and the result depends therefore upon the judgment of the designer and the accurate estimation of the values of each fundamental requirement.

This cannot be obtained from books and is usually not the product of aeronautical courses in universities but rather from long hard experiences in actual practice. Aviation students graduating from college should bear this in mind and realize that when they graduate their study of aeronautics is not finished but is just beginning. From that point on they begin to learn the application of knowledge and gain an understanding of the factors they are using through actual experience.

VICTORY

Frontiers

(Continued from page 15)

wing passes up through the slot and is ejected over the top of the flap at high speed, thereby keeping a smooth airflow over the flap, an unbroken boundary layer preventing burbling.

The whole secret of lift is the smooth airflow over any surface. Through these means extremely high lift coefficients have been obtained, some as large as three times the lift in a normal wing. With the slots and flaps shown here a coefficient of approximately 2.4 times the lift of a normal wing can be obtained; with the Fowler flap, which is a type that is extended rearward as well as being deflected, 2.8 times as much lift can be obtained; with the two-segment Grant flap 3 times the lift can be obtained.

By using these high lift devices liaison planes have been designed that fairly jump

off the ground; only very short runs are required and when in the air they climb at a very steep angle. Thus they can take off from restricted areas and clear obstacles such as trees, wires, etc., at the edge of the fields. They are none-the-less valuable in landing, providing a slow and steep descent so that after clearing obstacles close to the field they can land steeply and come to rest with a short run. Planes without high lift devices usually have a flat glide and land far from the edge of the field when obstacles have to be cleared. Also after landing they roll considerable distances before coming to rest—thus larger landing areas are required for them.

Because of the extreme performance necessary for these ships they have become a research problem which is distinct and entirely different from high speed fighter craft.

The number of enemy planes shot down in any action cannot always be measured by the efficiency and fire power of the airplane itself; the training of the pilot has much to do with victories in the air. To concentrate on plane design and neglect pilot training would be disastrous; one is as important as the other. So, behind the front in comparative obscurity thousands of planes less dramatic are operating daily to give that training and delicate touch to a host of young embryonic American fliers. Comparatively little is known of these ships because they are performing their daily function in an obscure and quiet manner. Nevertheless as much care is given to their design as in the case of the more dramatic frontline ships; in fact they are as carefully designed as any type of craft, for the lives of pilots in training depend upon their quality.

Second picture from the top, page 14, shows you one of these—the Boeing AT-15 Advanced crew training plane. It is certainly a sleek looking job though it is never intended to see the battlefront. In effect it is a miniature bombing plane though less powerful. It is fully equipped to function as its big frontline brothers, embodying radio compass, automatic pilot, radio equipment, movable machine guns, movable camera gun, power turret and moderate capacity bomb-bays. In effect it is a miniature, functioning in the same manner and to the same degree as a bomber. This ship has an approximate wingspan of 59 ft. with a speed of more than 200 mph. and with it the student goes through the exact procedure required in action.

Our next picture, third from the top, shows the famous British Whirlwind fighter bomber that is doing such excellent work over France and the low countries. In the last six months one Whirlwind squadron has destroyed or damaged as many as 37 trains carrying vital war materials in enemy-occupied territory; they also succeeded in destroying power stations, viaducts and enemy installations of vital importance.

They are extremely fast and, as you can see, of very unique design. The fuselage to the rear of the pilot has a small cros-section and weight has been reduced to a minimum. In effect it is a plane "built around" two powerful engines with as little plane as possible. Unusual maneuverability and steadiness of flight is attained by the

high stabilizer mounted on the fin. By placing it high the stabilizer acts in free air, undisturbed by the airflow over the wing, around the engine and forward part of the ship. When the stabilizer is placed low on line with the wing it is in the wing-wash. It is often ineffective, making it impossible to maneuver the plane precisely and quickly. Small bombloads are carried by these ships but after bombs have been dropped they can function as a pursuit fighter.

Though airplane plants are working intensely with production orders for standard designs, they have not neglected research and development of new craft, especially mammoth transport and bombing planes. The picture at the bottom of page 14 shows a new 250,000 lb. craft designed by the Glenn L. Martin Co. It was for this design, which can be translated at any time into an actual air vessel, and the 140,000 lb. Mars, largest flying-boat in the world, that Glenn L. Martin won the American Design Award a short time ago.

Mr. Martin reveals that this new ship will be able to carry 102 passengers, each with 80 pounds of luggage, plus 25,000 pounds of mail and cargo to London in 13 hours. As military transports, he said, such ships would be able to carry large numbers of troops and heavy supplies. As commercial vessels, for which the design was drawn, they would be able to rival, in a year of operation, the payload carrying of surface ships. Mr. Martin, whose firm built the China Clippers and her sisters as the first transocean commercial giants, declares now that the only limitation to the size of flying ships is commercial demand.

The Navy's new colossus, Mars, could carry 150 armed men and their equipment, Mr. Martin said, if it were used as a transport. The interior of the hull is equivalent to the interior of a 15-room house.

The picture at the top of page 15 shows the Martin Marauder taxiing in after a night landing. It is one of the fastest bombing planes in the world, with a speed close to the 400 mph mark. In order to attain high speed however landing speeds have been pushed up so that sometimes night landings are quite hazardous, but well within the capacity of our keen-eyed and steady-nerved American youth. This ship has done valuable work in the South Pacific, flying long distances with heavy loads of bombs. It is so fast that pursuit ships often have difficulty in keeping up with it, let alone overtaking it. It has been used with equal success in the cold of Alaska. In the Battle of Midway the Marauder emerged in the new role of a torpedo plane.

The second picture from the top, page 15, shows the famous Consolidated Liberator B-24. This, with the Flying Fortress, forms the present heavy-bombing team of the U.S. Army. It can carry more than six tons of bombs and has a range of 3000 miles. Recently Italy as well as Germany has felt the sting of this giant.

In the recent Tunisian campaign one of the greatest air battles of the war was fought over the Mediterranean when American fighters encountered a large convoy of immense German 6-engine troop transports. One of these ships is shown in the third picture from the top, page 15.

It is a Messerschmitt Me. 323, powered with 6 French Gnome-Rhone 14 M. radial engines, each of 800 hp. The landing gear is unique, being composed of five pairs of wheels fastened to the lower edge of the fuselage close to the nose. The large number of wheels is required because of the tremendous weight of the craft. Small wheels located in this manner help to reduce drag. The plane can carry a 22,000 lb. load or about 130 men. Designed for load carrying it, it has very broad wings, large fuselage capacity but correspondingly low speed.

Nearly every newspaper account of bombings of Germany by the British included the mention of 8000 lb. bombs. A bomb of this size stretches the imagination to the limit; 2000 lb. bombs used to be the maximum size and was considered powerful enough to destroy a large war vessel with one blow. But now we have bombs four times as large as this! The bottom left picture shows one of these immense missles of destruction on display in London. Beside it a soldier holds an ordinary 500 lb. bomb.

Communiques from the South Pacific occasionally mention the taking of Jap prisoners and in our imagination we try to picture what these sons of Nippon look like; the type of men, their dress and general appearance. The bottom right picture shows a group of Jap pilots recently captured in the Solomon Islands. They have just disembarked from a U.S. Army transport plane at an American field somewhere in the South Pacific. Their faces show varied emotions. Baldness apparently is unknown in Japan, for we call attention to the "thick mop" of hair on each one of these men. After scrutinizing them carefully it is not difficult to understand why our South Pacific pilots are knocking down five Japs to every one we lose.

VICTORY

Flash News

(Continued from page 2)

solidated flyingboats will play a vital role in the globe-girdling naval air transport service now being expanded from three to ten squadrons. Giant cargo carriers produced by Douglas, Martin and Lockheed will also be used in the service, for which Congress has appropriated $40,000,000 for enlargement of facilities and to form a basis for a post-war network of commercial airlines. Three main divisions—Atlantic, West Coast and Pacific—will be established, with headquarters at Patuxent River, Md.; Alameda, Cal.; and Pearl Harbor, Hawaii. Each division will have three squadrons equipped to operate on the fringe of battle zones and ready to occupy advance bases as soon as they are seized. At the end of its first year, the Navy Transport Service now covers more than 50,000 miles of routes and carries everything from bottles of iodine to submarine parts: on scheduled airline operation that has nevertheless been instrumental in the spotting of U-boats, the destruction of enemy vessels through wireless warnings and rescue of stranded seamen on floating rafts.

The story of Doolittle's raid on Tokio

has now been told and Shangri-la has been revealed as the aircraft carrier Hornet steaming towards Tokio in the broad North Pacific. Engineers still find it hard to believe but the fact remains that the heavily-loaded North American B-25's DID take off in distances ranging from 800 feet down to less than 600 feet! Normal takeoff distance for the type, lightly loaded, is 2,500 feet, and photographs of Doolittle's plane, the first to take off—with, therefore, the shortest possible takeoff distance—show the plane a good 20 feet in the air! Secret of the takeoff was the stiff head-wind, reportedly approaching gale velocity. Although the press stated the takeoff was made some 600 miles too soon, it was nevertheless made at the only time possible, for had the Hornet been operating in calm weather, the Mitchells would have been "decked" indefinitely.

The late Major General Robert Olds, who led the flight of Boeing B-17's to South America on a good-will tour in 1938, has been awarded the Distinguished Service Medal for: "Exceptionally meritorious and distinguished services in a position of great responsibility as Commanding Officer, Air Corps Ferrying Command." General Olds pioneered the North Atlantic Ferry Service from Canada to England, which work included the establishment of ground installations on both sides of the Atlantic and successful operation of the ferry service itself. In addition, General Olds set up an extensive flying force to ferry planes from American factories to takeoff points for trans-Atlantic flights by the British Ferry Service. He then opened the South Atlantic Ferry delivery and later the Pacific Ferry Service. The objectives desired have been achieved and surpassed due to the energy and ability of General Olds. Ferry services under his leadership have contributed in a very high degree to the defense of our country and its allies.

Civil airline pilots and other personnel engaged in work under contract for the Air Transport Command will wear special uniforms and insignia in the future, the War Department has announced. With more and more employees being engaged exclusively on work for the Air Transport Command, this step has been decided upon to designate ground and air crews which, while actually operating in a civilian status, are actually flying and servicing planes which are supplying all sorts of war material to the fighting fronts scattered throughout the world. Flight crew members will wear standard United States Army officers' uniforms with specially designed plastic buttons, a distinctive disc insignia representing the Kitty Hawk memorial on the shoulder straps and a blue hexagon shaped emblem with the letters "U.S.-A.T.C." on the lapels. Pilot wings will be standard "ATC" approved wings for each classification of pilot. Members of ground crews will wear standard non-commissioned officers' uniforms of the United States Army with plastic "ATC" buttons and lapel emblems like the flight crews.

VICTORY

Modeling Your Future in Aviation

(Continued from page 31)

stead of recovering gradually and smoothly it will suddenly dive. It is possible that the ship may not climb but will dive into the ground. This seldom happens however. Erratic behavior will be most evident and when thrown off balance, recovery will be delayed, if the plane recovers at all.

Reactions observed from these various tests are easily explained. First, the larger the tail surfaces the greater air pressure and righting effect they will produce. Consequently with the larger tail surface the plane will not deviate to as large a degree before recovery takes place as with the small tail surfaces. Naturally only a small change in angle with the large surfaces is required to produce sufficient righting effect, while with the small surface a large angular change is required.

Considered purely from a standpoint of stability, tail surfaces should be made extremely large; however efficiency deserves some consideration. Beyond a certain point stability is superfluous and very little is gained with increase in stabilizer size, so it becomes a compromise between efficiency and stability, resulting in a stabilizer sufficiently large for stability but not so large that efficiency will be impaired to a marked degree. The normal stabilizer size has been established as an excellent compromise and contributes both stability and efficiency to a large degree.

An excellent rule based upon all design conditions is:—make the stabilizer area equal to 1/3 of the total wing area (monoplane or biplane).

Now we are ready to determine the effect of the next important factor; the fin. This surface restrains sideways motion of the tail and tends to line up the plane directionally with its flight course, so it can be said to provide or effect directional stability. Following a course of reasoning applied to the stabilizer, it appears that directional stability is proportional to fin area. Only actual tests can prove this however, so attach the small-size fin to the stick of your test model, using the normal-size stabilizer.

Then proceed to test for balance with wing in normal position. The fin being smaller will also be lighter so a small weight will have to be attached to the stick, directly ahead of the stabilizer, as in the case of tests with the small stabilizer. Adjust the weight so the plane balances at the mark made on the stick.

Now you are ready for your first "fin" test flight. Wind and launch the plane in the customary manner. It will get underway and start to climb without unusual incident as long as speed is maintained. But as the climb becomes steeper and pace slackens, tail swing usually develops causing unsteady flight. If the climb is very steep tail swing will be excessive resulting finally in a spin as indicated in Fig. 111. Often the tail swings from side to side even in fast horizontal flight and causing a sideways roll simultaneously. This motion is referred to technically as a fugoid oscillation, and continues till the end of the flight unless the ship climbs steeply, whereupon a spin results.

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With the small fin it is obvious that flight is erratic directionally in the same way it is unstable longitudinally when a small stabilizer is employed.

Now test the plane with over-size fin. Results are not what you would expect. A large stabilizer makes a plane super-stable but a large fin does not. It stabilizes the tail it is true, reducing tail swing completely. In fact it holds the tail so steady when the plane banks while circling, that the nose slides inward and downward so the ship noses into the ground. Fig. 112 shows the flight course. Flight may be stable as long as the plane flies straight, but when it turns, the nose slides sideways toward the ground while the tail is held steady by the large fin.

The purpose of wing dihedral is to roll the plane back into normal flight when it banks excessively or at least to prevent the nose from sliding sideways more than the tail, thereby keeping level flight. However with over-size fin, normal dihedral is insufficient to roll back the plane to normal flight before the nose drops dangerously and the plane dives.

So obviously there is a definite relation between fin area and dihedral angle required. Large fin area does prevent spinning, but induces side slipping and nose dives *unless the dihedral angle is increased proportionally* or some other steps are taken that have the same effect, raising the wing for instance.

A rule for fin area that proves satisfactory in nearly all cases is:—make the fin area equal to 12% or about 1/8 the total wing area, for rubber powered planes: biplane fins can be 9% of the wing area; for gas models, 6%. Dihedral angle under these conditions should be equivalent to an elevation of each wing tip of 3/4" to 1" for every foot of wing span. Normal dihedral for a wing of 24" span is given by raising tip 1-1/2" to 2" above its center chord.

Tests showing the influence of dihedral and other lateral stability arrangements will be outlined next month.

VICTORY

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—than the Eye!

—and if it's quicker—and better—Ohlsson and Rice engineers will use it. The same methods that made Ohlssons marvels of miniature motor efficiency and stamina are now making precision tools for aircraft faster—and a little better—than they have ever been produced.

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The other is the method devised by Ohlsson and Rice engineering. With automatic cycling, this little machine countersinks two sides at a time. It trebles production, freeing labor for other jobs. Insures perfect uniformity of every part. And incidentally, compensates for wear on the cutting edges!

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